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NOISE ADDENDUM
EXPERIMENTAL CLEAN COMBUSTOR PROGRAM
PHASE I
FINAL REPORT

by

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PRATT & WHITNEY AIRCRAFT DIVISION
UNITED TECHNOLOGIES CORPORATION

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In accordance with the terms of Exhibit A, Part III, Task B-4-b of the referenced contract, as modified by Modification 6, we are submitting herewith 1 copy of the subject report.

UNITED TECHNOLOGIES CORPORATION
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16. Abstract

A Noise Addendum was executed on 7 December 1973 to the NASA Experimental Clean Combustor Program, Contract NAS3-16829, under which Pratt & Whitney Aircraft was developing technology for advanced CTOL aircraft engines having reduced exhaust emissions. The purpose of this Addendum was to provide combustor noise information during the basic emissions program which could be used to advantage in securing reduced levels of combustion noise as well. This report presents results of internal pressure transducer measurements made during the scheduled emissions test program on ten configurations involving variations of three basic combustor designs. In the next phase of the program, analysis of this information will be performed and the nature of the dependence of the noise data on combustor design and operating conditions will be explored.

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FOREWORD

This report was prepared for the National Aeronautics and Space Administration Lewis Research Center under Modification 4, the Noise Addendum, to Contract NAS3-16829. It presents internal combustor noise data acquired under Phase I of the Experimental Clean Combustor Program.

Appreciation is expressed for the contributions made by Mr. Ronald Huff of NASA Lewis Research Center and by Messrs. R. Roberts, A. Peduzzi and G. E. Vitti of the Combustion Technology Group at P&WA.

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NOISE ADDENDUM
EXPERIMENTAL CLEAN COMBUSTOR PROGRAM
PHASE I FINAL REPORT

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SUMMARY

Combustor noise data were acquired on ten variations of three basic JT9D scale experimental combustor designs with the object of providing information for correlating combustor noise levels with performance parameters. These data were obtained as an add-on program to the 90° segment rig tests being conducted to study emission levels under the NASA Experimental Clean Combustor Program. Data were acquired on the following basic combustor designs:

- Swirl-Can Combustor
- Staged Premix Combustor
- Swirl Vorbix Combustor

Flush mounted internal pressure transducers were installed to record noise in the aft segment of the burner liner and upstream of the combustor. The signals obtained were considered to be representative of local, near field pressure fluctuations on the combustor walls and were not necessarily representative of noise radiated to the far field. The difference is due to the fact that the local measurement is not necessarily representative of the mean chamber fluctuation, and, secondly, the internal pressure wave is transformed in its passage through the combustion chamber rig and exit. The data acquired during the test series are presented in one-third octave sound pressure levels and in narrow band spectrum analysis plots. In all the configurations tested, the combustor internal fluctuating pressure level was relatively insensitive to fuel-air ratio. However, significant increases in level resulted from burning compared to the cold flow baseline data. Simulated sea level takeoff operations produced higher levels than those obtained at the comparatively low pressure idle condition. Detailed analysis of the data will be performed in the next phase of the program, in which the dependence of the noise data on combustor design and operating conditions will be examined.

INTRODUCTION

As the aircraft engine noise sources from the fan, jet, and turbine are successfully reduced with improved engine design and noise treatment, the possibility arises that engine combustion noise could emerge as a dominant noise source. In order to accumulate noise data for correlation with combustor performance parameters, measurements are needed on test vehicles in which these parameters can be independently varied. The NASA Experimental Clean Combustor Program, under which Pratt & Whitney Aircraft would develop technology for advanced CTOL aircraft engines having reduced exhaust emissions, provided an opportunity to acquire

some of these data simultaneously with the primary emissions test program. The results of the primary emissions test program are reported in the Experimental Clean Combustor Program Phase I Final Report (Contractor's ref. PWA-5153), NASA-CR 134736 (Reference 1). Modification 4 to contract NAS3-16829 with Pratt & Whitney Aircraft authorized the acquisition of combustor noise information, which could be used to advantage in securing reduced levels of combustion noise, as an add-on program to the basic emission investigation. The results of the add-on program are presented in this report.

The technical effort was conducted in three tasks. Task B-1 involved the definition, acquisition and installation of noise instrumentation in the Experimental Clean Combustor Program (ECCP) combustors. Task B-2 required the acquisition of noise data from ten ECCP combustor configurations, concurrent with the primary emissions testing. Data were obtained at a minimum of three fuel-air ratios and a minimum of one point with no combustion, for each of the idle and SLTO operating conditions. Task B-3 involved analyzing the data acquired during Task B-2 to obtain the one-third octave band and narrow band spectra.

COMBUSTOR MECHANICAL EQUIPMENT AND TEST FACILITIES

COMBUSTORS

Combustor noise data were acquired for ten separate burner configurations which included all three of the basic designs being evaluated in the NASA Experimental Clean Combustor emissions program. The three basic combustor configurations are described in detail in the Experimental Clean Combustor Phase I Final Report, NASA-CR-134736, principal design features are outlined below:

SWIRL-CAN COMBUSTOR

The swirl-can modular combustor design utilizes concepts developed by the NASA Lewis Research Center. This combustor incorporates a carburetor module array of 40 swirl cans in each of three circumferential rows, on a full annular basis. Each module is constructed with three major components: a carburetor, swirler, and flame stabilizer. The baseline configuration is shown in Figure 1a. Fuel is supplied to the modules through injection tubes centered in the carburetor-cans. The fuel-air mixture passes through the swirlers and is then burned. Dilution air enters the combustion chamber around hexagon shaped flame stabilizers. Fuel is staged to the outer row of carburetor cans at idle and to all the swirl cans at higher power. Figure 2 is a photograph of a 90° sector of this design tested in the burner rig.

Six Swirl-Can Combustor Configurations were evaluated during this program. These are listed in Table I and briefly described in the sketches presented in Figures 1b and 1c. Modifications were confined to diffuser inserts, in an attempt to provide more uniform diffuser flow, and carburetor module changes to alter flameholding characteristics and carburetor fuel-air ratio. In one modification, configuration N-11, inner and outer liner dilution holes were provided.

STAGED PREMIX COMBUSTOR

The design of the Staged Premix Combustor is based on previous single and two-stage premix combustor development conducted at Pratt & Whitney Aircraft. Figure 3a presents the

baseline design and Figures 4 and 5 provide two photographic views of the test sector. The basic principle of the design involves use of two combustion zones, denoted as pilot and main. Each zone has a separate fuel injector array, premix passage, flameholder, and combustion volume, as may be seen in Figure 3a. Two zones are employed with the intent to facilitate emission control over the range of engine operation more readily than can be accomplished with a single zone combustor. The pilot zone is sized to accommodate all heat release for idle operation and is designed for optimum emission control at idle. With appropriate fuel management the combination of both pilot and main systems can be optimized for the high power operating regime.

Two configurations of the basic Staged Premix Combustor were tested, as indicated in Table I. Both incorporated slotted pilot and main flameholders, as shown in Figure 3b with no liner dilution air. This produced a very lean bulk premix passage equivalence ratio. Configuration P-8 additionally incorporated 2X main zone fuel source density. This was accomplished by substitution of the main fuel injector design shown in Figure 3c.

SWIRL VORBIX COMBUSTOR

The Swirl Vorbix (Vortex Burning and Mixing) Combustor also employes two combustion subsystems, as shown in Figure 6a. The pilot zone is a conventional swirl stabilized, direct fuel injection design and is sized to provide all heat release at high efficiency during idle operation. At higher power conditions, main zone fuel is introduced through fuel injectors located downstream of the pilot combustion zone. Main combustion and dilution air is introduced into the main burning zone through 60 swirlers located on each side of the combustor (on an annular basis). The hot exhaust product - fuel vapor mixture is entrained by the swirling air jets and partial premixing occurs prior to auto ignition of the main zone fuel. The main combustion process, in which most of the fuel is consumed at high power conditions, proceeds rapidly at the interface between these jets and the surrounding fuel rich pilot jet mixture. Photographs 7 and 8 show two views of the test configuration.

Two configurations of the Swirl Vorbix Combustor were evaluated, S-8 and S-9. Configuration S-8 differed from the baseline design in that pressure atomizing fuel nozzles were substituted for the aerating pilot zone nozzles, and large swirlers were installed at the main throat location. These had somewhat more than twice the effective flow area of the baseline swirlers, and necessitated the elimination of all aft liner dilution holes in order to maintain pressure drop. These changes are summarized in Figure 6b. With reference to configuration S-8, S-9 incorporated pilot swirler blockage rings to increase pilot zone equivalence ratio, and modified the orientation of the main fuel injectors. These changes are shown in Figure 6c. The downstream injection of main fuel was intended to minimize combustion prior to mixing with the main swirler airflow.

More detailed specifications of the ten configurations tested under the Combustion Noise Addendum may be found in Appendix B of Reference 1.

TABLE I

COMBUSTOR DESIGN MODIFICATIONS EVALUATED
IN ACOUSTICAL PROGRAM

Combustor	Scheme	Configuration	Figure Ref.
Swirl-Can Combustor	N-7	Diffuser Screen; 1.27 cm recessed swirlers	1b, 1c
	N-8	"V" gutter trip; non-recessed swirlers	1b, 1c
	N-9	Diffuser screen; outer swirler flame-holder design.	1b, 1c
	N-10	Diffuser screen; reduced swirl can air.	1b, 1c
	N-11	Diffuser screen; ID and OD dilution air.	1b, 1c
	N-12	Diffuser screen; outer swirler flame-holder design; pressure atomizing nozzles.	1b, 1c
Staged Premix Combustor	P-7	No dilution air; slotted flameholders pilot and main.	3b
	P-8	No dilution air; slotted flameholders pilot and main; 2X main fuel nozzles.	3b, 3c
Swirl Vorbix Combustor	S-8	No dilution air; high flow main swirlers; pressure atomized pilot fuel nozzles.	6b
	S-9	15 percent pilot swirlers blockage; main fuel nozzles aimed downstream.	6c

TEST FACILITY

The combustor noise tests were conducted on X 903 stand, a high pressure combustion component test facility located at the Pratt & Whitney Aircraft Experimental Test Department, Middletown, Conn. This facility was fully equipped with the necessary inlet ducting, exhaust ducting, controls and instrumentation for conducting component tests at simulated engine operating conditions. For testing, the combustor test rig containing the combustor was installed at the inlet and outlet flanges of the test stand ducting. Heated non-vitiated compressed air was supplied to the test rig and the discharge pressure was controlled by valves in the exhaust ducting, allowing operation over a range of test conditions.

COMBUSTOR TEST RIGS

Three complete 90 degree sector combustor rigs were fabricated for use in this program. A JT9D-7 engine diffuser/burner case was sectioned to provide the same strut orientation in all three rigs. Each case was re-operated to provide the fuel support pads and instrumentation bosses required by the particular combustor design. Stand duct work and flanges were also fabricated to mate the rig to the facility. A schematic diagram of the test rig, showing the location of the performance instrumentation is given in Figure 9.

PERFORMANCE INSTRUMENTATION

Instrumentation was provided to measure the variables required to determine combustor performance, such as air flow, fuel flow, fuel temperature, static pressure and total temperature at the combustor inlet, and total temperature and pressure of the gases at the exhaust of the combustor.

ACOUSTICS INSTRUMENTATION AND TEST PROCEDURE

TRANSDUCER INSTALLATION

Combustor noise measurements were made using Kistler Model 603A1 dynamic pressure transducers. The transducers were installed in Kistler water cooling jackets, model 616M135, in order to protect the transducer from the extreme temperatures. The transducer installation is shown schematically in Figure 10. The inlet transducer was located on the ID wall of the combustor inlet duct, 0.299m upstream of the diffuser case forward mounting flange. The inlet duct was common to all three combustors and thus it was not necessary to remove the transducer during combustor changes.

The sidewall combustion compartment transducers were located in the same relative locations in all three combustor configurations. The locations were in the combustor sector sideplates, centered radially approximately 0.0859m forward of the combustor rear mount flange. Details of the combustor sidewall transducer installation are shown in Figure 11. Combustor rig flow areas at the noise measurement stations are of interest for noise data correlation. The cross-sectional flow areas for the three combustor concepts are summarized in Table II. The flow area at the inlet transducer station is the compressor discharge area. Flow area at the combustion chamber noise measurement station is defined as the cross-sectional area within the combustor liners perpendicular to the engine centerline. The values contained in Table II correspond to the 90° sector rig used in this program. Combustor burning length, also of interest for noise data correlation, is also included in Table II. Burning length is defined as the developed distance from the plane of the pilot zone fuel injectors to the leading edge of the turbine inlet guide vanes.

TABLE II

COMBUSTOR DIMENSIONS AT THE NOISE MEASUREMENT STATIONS

Combustor	Cross-Sectional Flow Area[(a)] (m^2)		Developed Burning Length (m)
	Inlet Transducer	Combustion Chamber Transducers	
Swirl-Can	0.02002	0.117	0.282
Staged Premix	0.02002	0.117	0.368
Swirl Vorbix	0.02002	0.064	0.419

(a) 90° sector rig values

Due to procedures required for installing the combustion compartment transducers, it was necessary to install them as the combustor was being assembled. This required at least two separate sets of transducers allowing one combustor to be built up while another was at test. Since the Combustion Noise Addendum was an add-on program, the data acquisition was conducted on a non-interference basis with the primary program. Consequently, in some cases malfunctioning transducers could not be replaced after a test started.

Kistler transducers have been known to generate a signal when mounted on a vibrating structure, such as an engine case. It is believed that the current burner rig installation is sufficiently free from vibration that this problem has not affected the data. Confirmation of this assessment is planned for Phase II of the program.

TRANSDUCER CALIBRATION

Output sensitivity and frequency response of the dynamic pressure transducers were determined using the P&WA Dynamic Pressure Transducer Transfer Calibration System, shown schematically in Figure 12. The output sensitivity was determined using a B&K type 4220 Pistonphone calibrator and a B&K type 4134 0.0127m microphone. The Pistonphone and microphone were both calibrated at the P&WA Standards Laboratory. An adjustable noise source was set to an output level of 150 dB at 1000 Hertz, and then applied to each transducer assembly. The transducer output frequency response curves were generated using a B&K type 4136 0.0064m diameter microphone, calibrated in the P&WA Standard Laboratory and having a flat response from 30 to 5000 Hertz, as a reference. A noise source was driven from 30 to 5000 Hz with an audio oscillator, and the outputs of the reference microphone and the pressure transducer being tested were transcribed onto strip charts.

The transducer output frequency response from 30 to 5000 Hertz was determined for each transducer both free and as installed in the water jacket. Response curves for the trans-

ducers without water jackets are shown in Figures 13 and 14. Response curves for the transducers installed in water jackets are shown in Figures 15 and 16. The response curves provided sound pressure level corrections which were applied to the one-third octave band analysis of the combustor noise data. The response corrections applied are tabulated in Appendix B, indicating transducer serial number and combustor scheme number.

NOISE DATA RECORDING SYSTEM

The data recording system was comprised of: 1) the high response pressure transducers and their power supplies, and 2) the signal conditioning and recording equipment, which provided calibration and monitoring instrumentation, switching capability, and analog magnetic tape recording capability. Figure 17 is a schematic diagram of the data recording system. Recording system response calibration signals were provided by a local oscillator and random noise generator. Gain settings established on each channel at the pre-amplifier, to obtain optimum signal to noise recordings, were noted on the recorder log sheets and announced on the tape voice channel.

NOISE DATA REDUCTION SYSTEM

A schematic diagram of the one-third octave pressure analysis system is shown in Figure 18. The recorded pressure signals were frequency analyzed using a set of 24, one-third octave band filters having geometric mean frequencies extending from 50 Hz to 10 kHz. These filters complied with the filter characteristics recommended in IEC Publication 225 (Reference 2).

The system was set up to provide a readout of one-third octave levels for each transducer, time averaged over a minimum time period of 30 seconds for each operating condition. Following this analysis, the data were stored on digital magnetic tape for input to the computer. Recording response and transducer frequency response corrections were applied to the data in the computer from 50 Hz to 5 kHz.

Narrow band (16 Hz bandwidth) analyses were performed on a high speed spectral analysis system, shown in Figure 19. This system provides wide-range, high-speed digitization of the narrow band analysis analog data. Resultant spectra were stored and averaged in a local memory before being plotted as narrow band spectrum plots. A 7-second real time average was provided by the local memory.

TEST PROCEDURE

During each combustor test session, noise data were acquired from one upstream (inlet) pressure transducer and two combustion compartment pressure transducers. Data were acquired at a minimum of eight combustor operating conditions. One point with fuel off (cold flow) and three hot-flow points with varying fuel-air ratio were recorded at idle. Three hot-flow points with varying fuel-air ratio and one cold-flow point with fuel off were recorded at Sea Level Takeoff (SLTO) conditions. The following combustor performance parameters were recorded with each noise data point taken during hot flow operation.

- Mass flow rate of air
- Mass flow rate of fuel to primary and secondary zones
- Total temperature at combustor inlet
- Total and static pressure at combustor inlet

Combustor fuel-air ratio was computed from a carbon balance performed on the measured exhaust gas species concentrations. This value of gas sample fuel-air ratio is typically found to exceed the corresponding fuel-air ratio determined from metered fuel and air mass flows. This discrepancy is primarily due to exit plane radial profile effects and the existence of side-wall cooling airflow in a sector rig, as well as to accumulated inaccuracies in the individual gas concentration measurements. In the present sector rig experiments, the computed carbon balance fuel-air ratio is thought to provide the better representation of actual combustor operation. It is recommended that this parameter be used in the correlation of noise data.

The following additional combustor performance parameters were calculated for possible use in correlating the combustion noise data:

- Ideal average exit temperature
- Compressor discharge mass flow parameter
- Combustor liner pressure drop
- Average combustor temperature rise

The measured and computed performance data are tabulated in Appendix A for each of the ten configurations tested. All of the performance data were not always available for the cold flow conditions, since the points were often run before or after the computer data link was "on–line". In this instance, estimated values are provided.

COMBUSTION NOISE DATA SUMMARIES

The combustion noise data measured in this program are presented as tabulations of one-third octave band pressure level, one-third octave band pressure level plots, and as narrow band spectrum analysis plots. The one-third octave pressure levels for each noise transducer are displayed on computer printout for each combustor data point recorded. The data points are identified by the combustor running program point numbers. The one-third octave pressure levels have been corrected for transducer frequency response at the one-third octave center frequencies from 50 through 5000 Hz. The computer generated tabulations are contained in Appendix C. Combustor transducer one-third octave band pressure levels, plotted against one-third octave center frequency, are presented in Appendix D. Narrow band spectrum analysis plots indicate (uncorrected) pressure level in dB versus frequency from 0 to 5000 Hz. The narrow band filter bandwidth is 16 Hz. A selected number of the narrow band plots generated in this program, identified by transducer location and combustor test program point number are presented in Appendix E.

DISCUSSION OF RESULTS

GENERAL

Preliminary examination of the pressure transducer data acquired in the ten test series has indicated several characteristics that were common to all three basic combustor concepts:

1. Foremost is the indication that there were relatively small changes in chamber fluctuating pressure level with variations in fuel-air ratio at either the idle or SLTO operating conditions. Figures 20 and 21 illustrate the insensitivity at both idle and SLTO using data from the configuration N-8 as representative.

2. Generally there were very few indications of discrete frequency tones that can be attributed to combustion. Examination of the spectra, Appendices D and E shows that the discrete frequency tones occasionally present also exist in the corresponding cold flow spectra, indicating their source to be flow-generated rather than due to burning. There are also several indications of 60 Hz harmonics which are assignable to electrical sources and thus do not obscure the pressure information.

3. Signal levels from the transducer in the air entrance duct upstream of the combustor were generally much higher than those from the combustion section. The data in Appendix C show several instances where the inlet levels exceeded the combustor levels by 30 to 40 dB. Post-test checkout indicated no instrumentation malfunctions. There is a strong possibility that flow turbulence due to upstream valves was impacting the inlet transducer, and therefore the signals should not be construed as an indication of propagating noise. There were also occasional instances when one of the two combustor transducers produced similar high amplitude fluctuations in the low frequency domain of the spectrum.

4. A set of one-third octave band spectra, Figures 22 through 30, has been prepared from the material in Appendix D to give a capsule view of the behavior of the test configurations. No information is given for configuration N-7 for reasons to be described presently. In each figure, the left hand part corresponds to idle operation and the right hand side gives the SLTO characteristics. The cold flow spectra are given along with representative spectra for burning, it having been established that fuel-air ratio variation effects were minor. Comparing the upper curve in each plot with the lower cold flow curve shows the change in signal associated with burning. Notice that the sound level scales start at 120 dB for the N series and change to 130 dB for the P and S series curves.

Although exceptions can be found (notably configuration S-9) the effect of combustion is to produce an increase in level over portions of the frequency range. To farther particularize the magnitude of the combustion noise increment and specify the frequency range over which it occurred is a matter that cannot be summarized briefly. Descriptions of the combustion noise characteristics and other pertinent information follows for the three basic combustor concepts.

SWIRL CAN COMBUSTOR

In configuration N-7 the right hand transducer malfunctioned during the entire program, and the left side transducer was inoperative during the takeoff portion of the program. For the idle conditions, the left transducer indicated high amplitude, low frequency fluctuations. Third octave spectra for cold flow and the three burning points may be found in Appendix D. It should be noted that the low frequency levels with burning are on the order of 15 dB *lower* than the cold flow condition. No explanation for this behavior, which is an extreme case of the trend described below for configuration S-9, has been found. However, it is clear that the N-7 data are not representative of combustion noise, and accordingly they have not included in the series of comparative curves, Figures 22 through 30.

In configurations N-8 through N-12 the left and right transducers indicated levels comparable to each other; for simplicity only the left side transducer data are shown in the spectra of Figures 22 through 26. The physical changes associated with these five modifications resulted in pressure spectra that are remarkably similar. This similarity is illustrated for the takeoff condition in Figure 31 and a comparable grouping also holds for the idle conditions. With the exception of configuration N-11 moderate increases in level result when changing from idle hot to SLTO hot conditions. Finally, by comparing the N series summary curves, Figure 31, with the takeoff condition plots for the P and S series it is seen that the Swirl Can Combustor operated at lower fluctuating pressure levels than the other combustors. This relative standing also holds for the idle operating condition.

STAGED PREMIXED COMBUSTOR

Because of problems with low frequency fluctuations in the left side transducer in configuration P-7, third octave level data are presented only for the right hand transducer in both P7 and P8 configurations. The effect of burning on the noise of both these configurations is clearly evident in Figures 27 and 28. Takeoff levels are significantly higher than those produced at idle operation in both configurations. Moreover, as shown in Figures 32 for idle and 33 for takeoff, the noise spectra of these two configurations are generally quite similar.

SWIRL VORBIX COMBUSTOR

The display in Figure 29 clearly indicates the increase in noise for configuration S-8 when combustion occurs. Somewhat less than 10 dB from 630 Hz to 1630 Hz results from burning at idle and SLTO conditions, although the details differ at these two powers. Only the left side transducer output is shown since the right hand side unit became inoperative during the SLTO portion of the program. At takeoff both the background cold flow noise and the noise with burning are somewhat higher than their counterparts at the idle condition. This trend seems to prevail in the majority of test cases, but there are sufficient exceptions (e.g. N-9, N-11) to disallow making a rigid generalization.

The performance of configuration S-9, is completely different, not only from S-8, but also when compared with all other configurations tested. A glance at Figure 30 shows that both idle and SLTO conditions are dominated by flow noise. When the burner was ignited certain frequency band levels actually decreased slightly. Additionally, the levels are significantly greater than those of all other configurations, particularly in the low frequency

domain. It has not yet been possible to identify any geometric feature associated with configuration S-9 that would account for this unusual behavior. Therefore, since the transducer outputs in the S-9 test series are dominated by flow noise none of the S-9 data should be used for inferring combustion noise properties, even though the spectral data are included in this report.

A summary of transducer outputs that are considered free from malfunction and spurious effects is given in the following table:

TABLE III
VALID DATA POINTS

Configuration	Left	Right
S-8	x	x (idle)
S-9		x
P7		x
P8	x	x
N7		
N8	x	x
N9	x	x
N10	x	x
N11	x	x
N12	x	x

CONCLUSIONS

Data on combustion chamber pressure fluctuations have been obtained for modifications of three basic combustor designs. Analysis of the results for this phase of the program and a determination of the relations between combustion noise and operating characteristics are scheduled to be performed in a Phase II follow-on effort. At this point it is possible to draw the following conclusions based on the information summarized in the preceding section, Discussion of Results:

1. For all combustor configurations there was virtually no change in fluctuating pressure level with changes in fuel-air ratio. There was, however, a significant increase in level when changing from flame out to hot-flow conditions, indicating that the downstream transducers responded to disturbances associated with combustion.

2. Generally the takeoff pressure levels were higher than the corresponding idle operating values, although the frequency range of this increase varied among the test configurations.

3. There were very few indications of significant discrete frequency tones due to combustion.

4. The Swirl-Can Combustor displayed generally lower internal signal levels than the other two combustor designs.

5. No significant changes in pressure fluctuations were noted to accompany modifications to the Staged Premixed Combustor or the Swirl Can Combustor.

REFERENCES

1. Roberts, R., Peduzzi, A., and Vitti, G. E., "Experimental Clean Combustor Program Phase I Final Report", NASA CR-134736 (Contractor's ref. PWA-5153).

2. IEC Publication 225 (Noise Section).

ROG-3

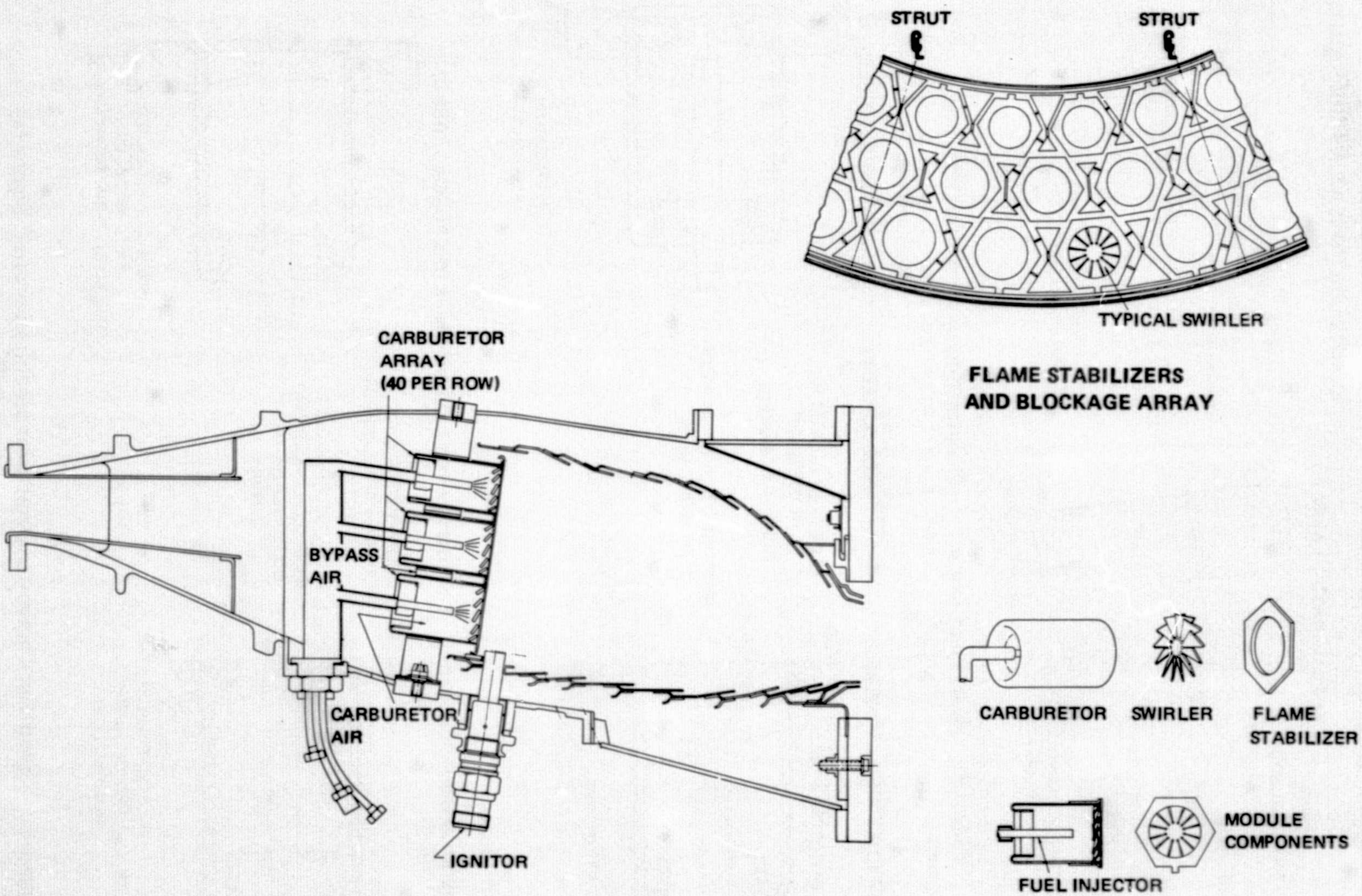


Figure 1a Swirl Can Combustor – Baseline Configuration

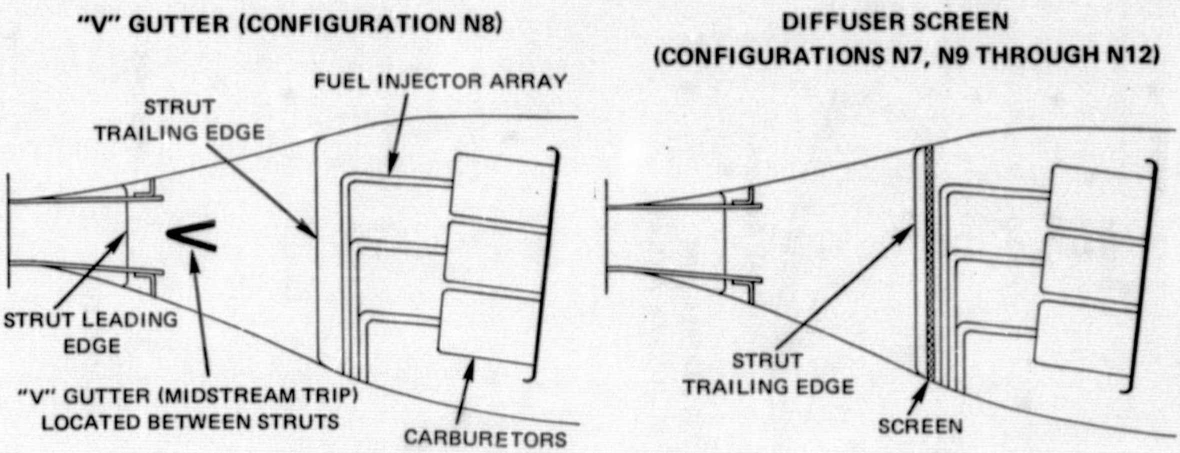


Figure 1b Swirl Can Combustor - Diffuser Modifications (ref. Figure 1a)

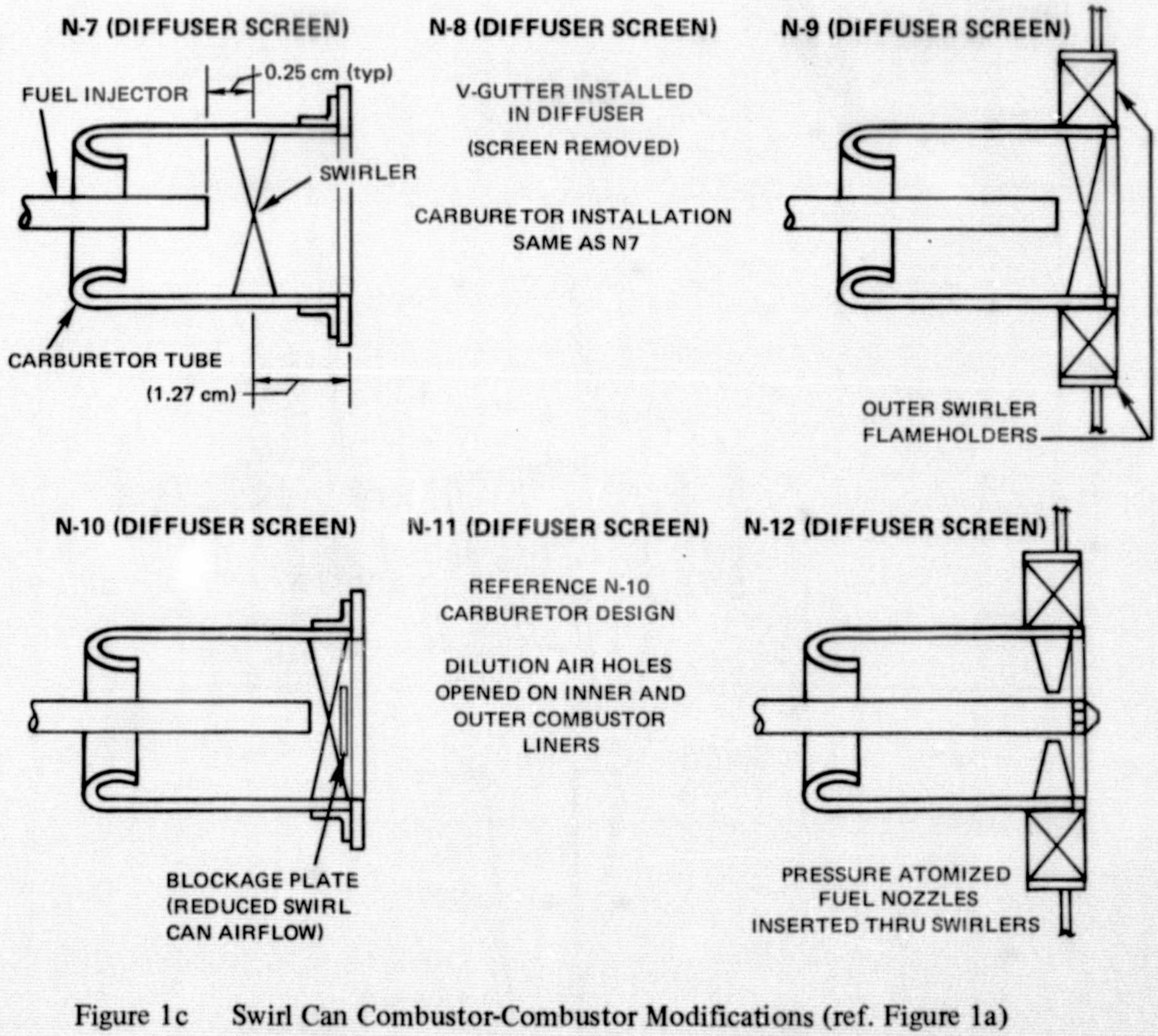


Figure 1c Swirl Can Combustor-Combustor Modifications (ref. Figure 1a)

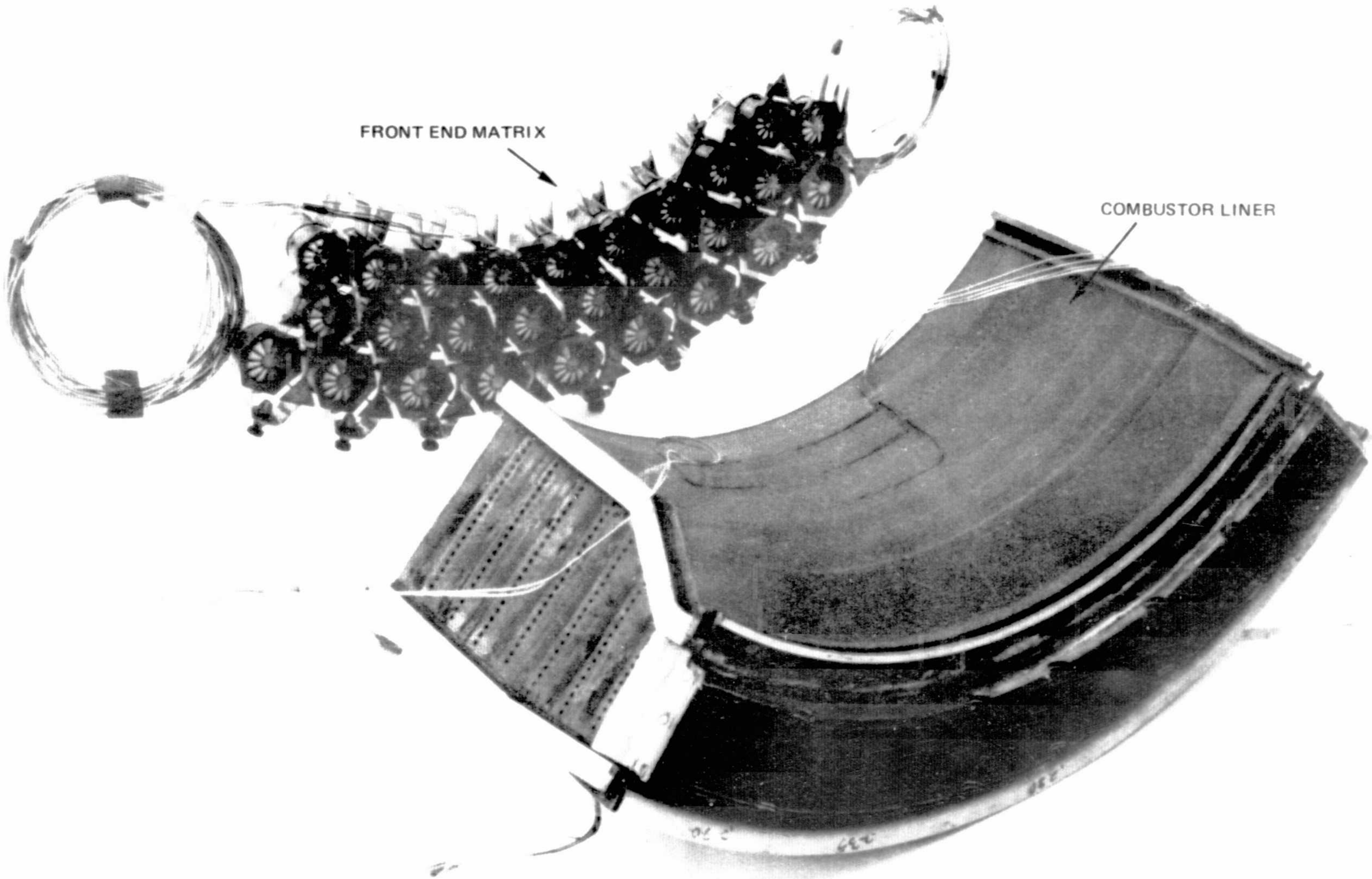


Figure 2   Swirl Can Combustor Liner and Carburetor Headplate Array

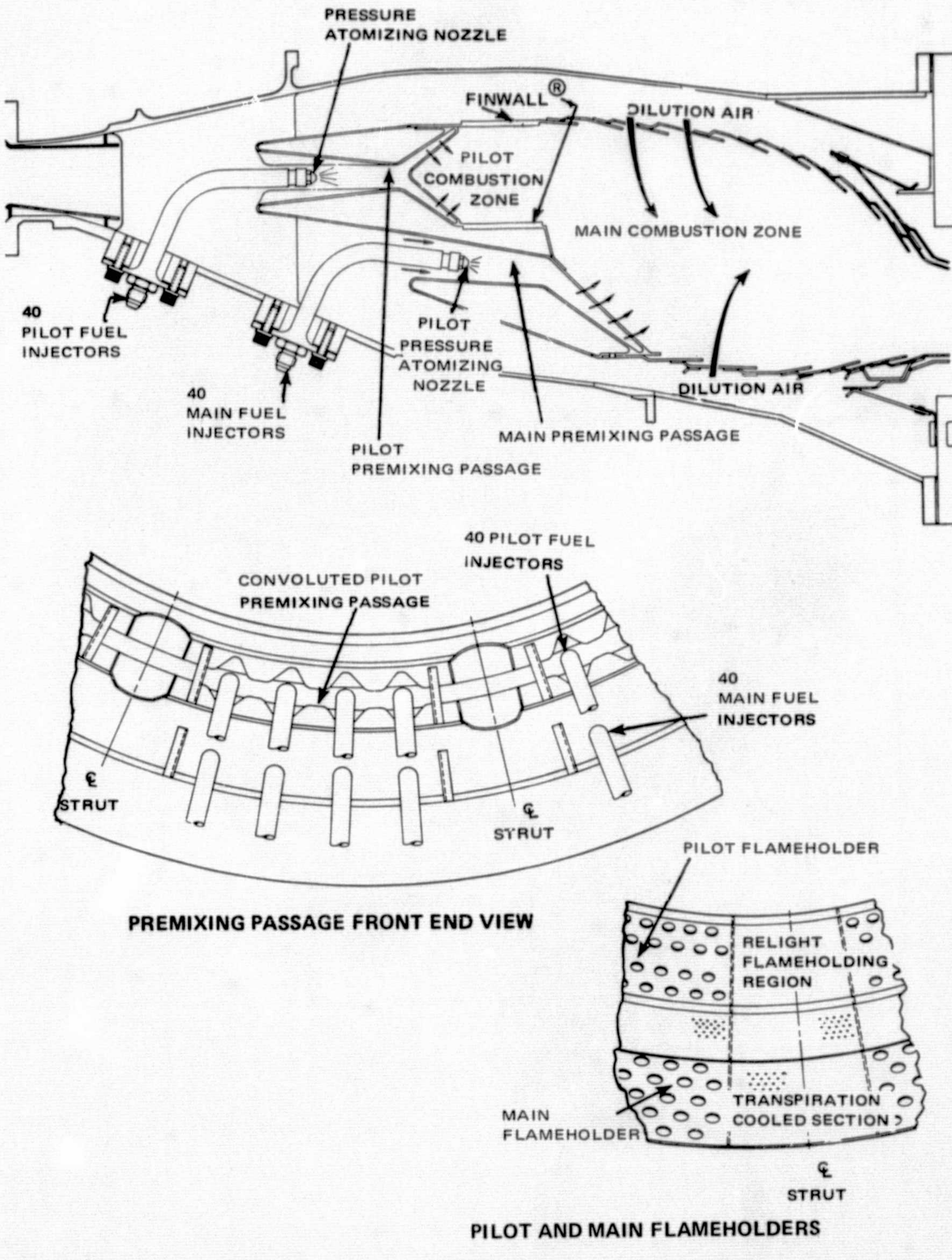
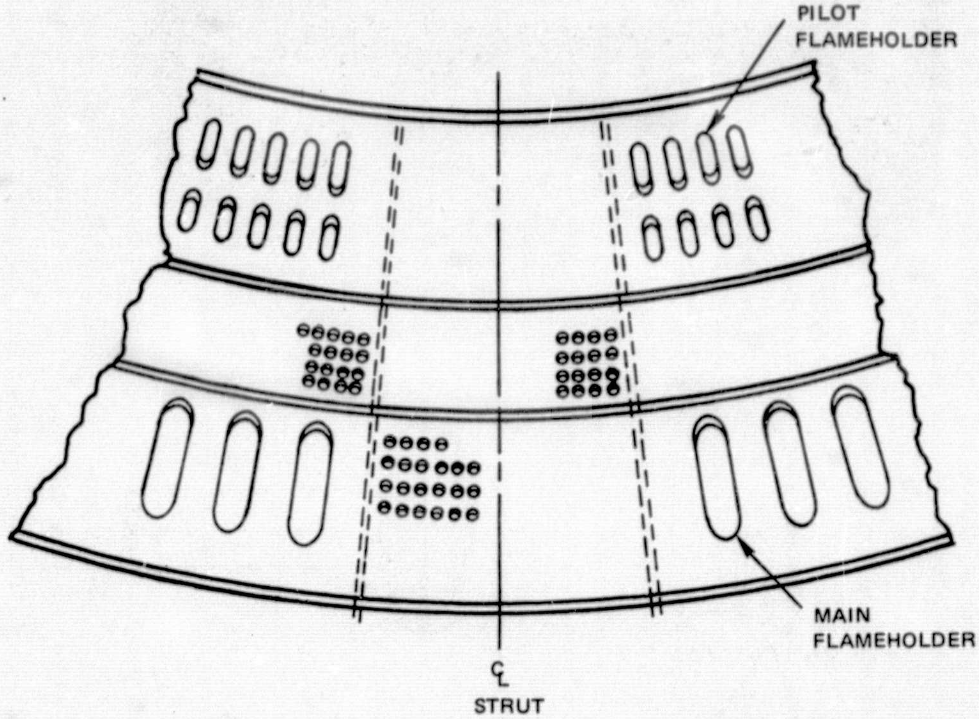


Figure 3a Staged Premix Combustor-Baseline Confiuration



NOTE: INNER AND OUTER LINER DILUTION AIR HOLES NOT USED WITH SLOTTED FLAMEHOLDERS

Figure 3b Staged Premix Combustor–Slotted Flameholder Configurations P-7 and P-8 (ref. Figure 3a)

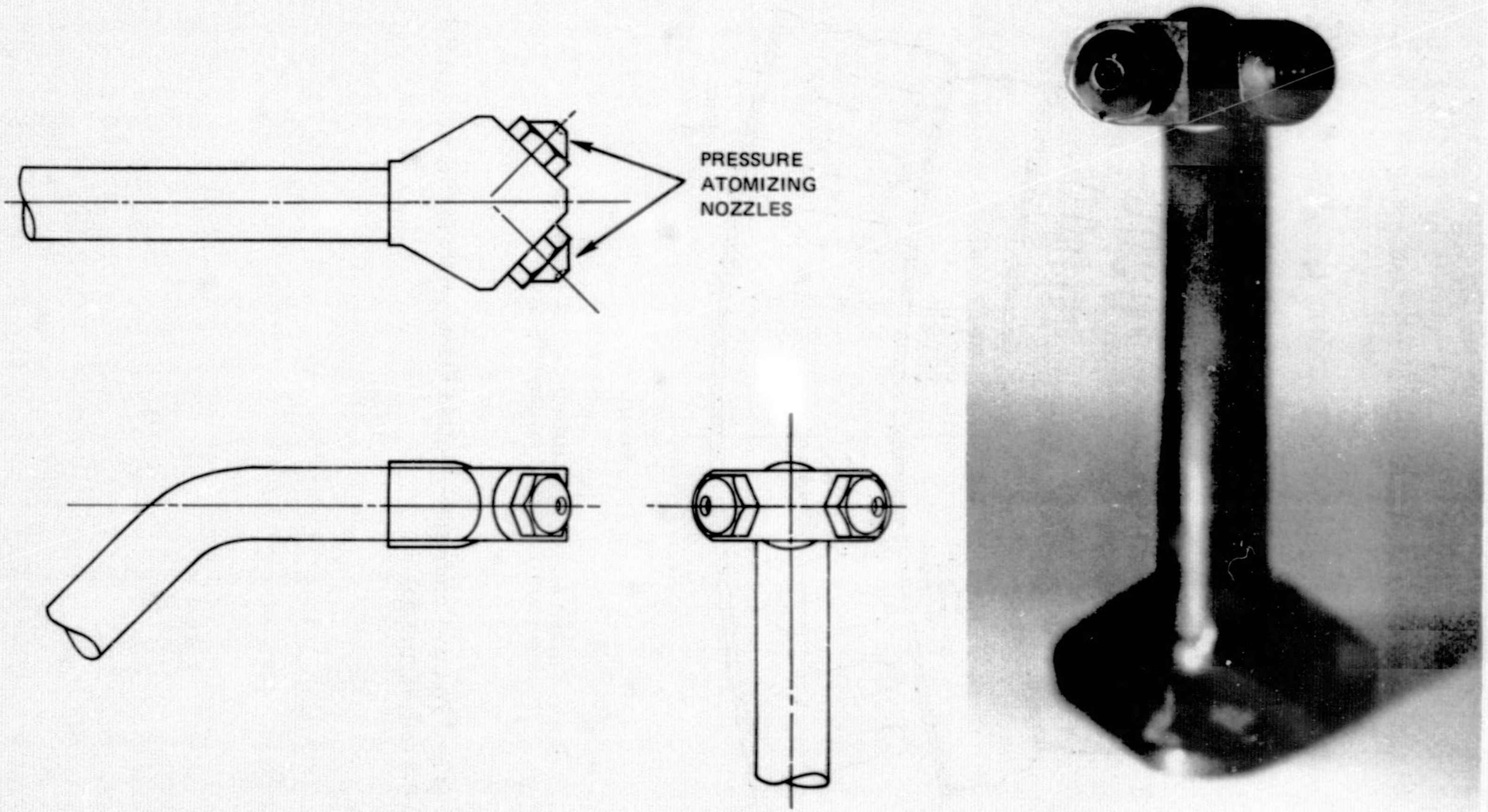


Figure 3c Staged Premix Combustor – 2X Density Main Fuel Injector

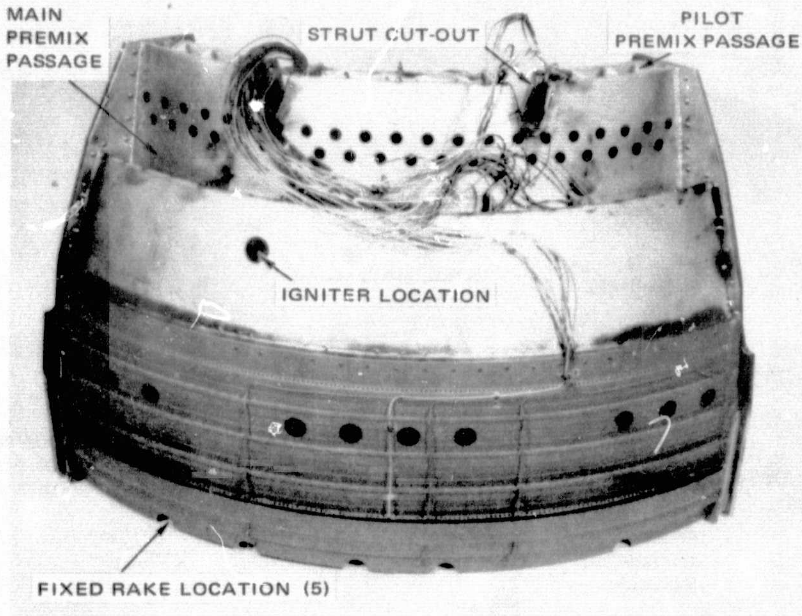


Figure 4 Staged Premix Combustor Rig Liner, Side View

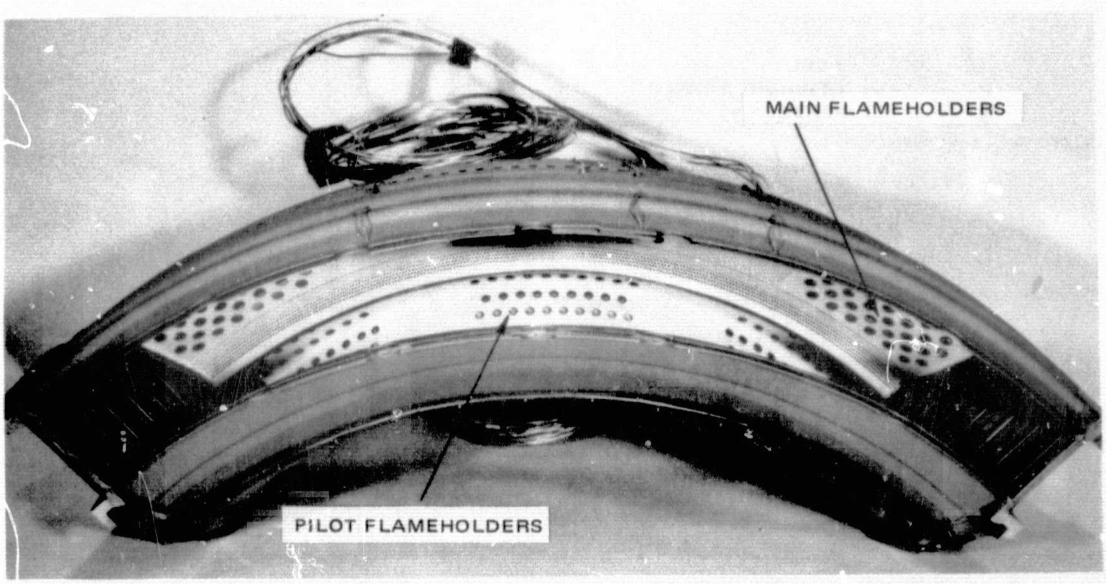
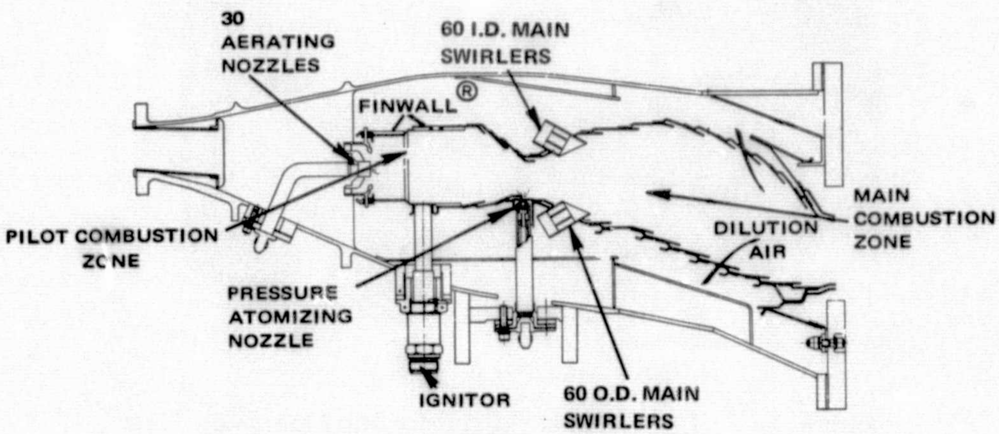
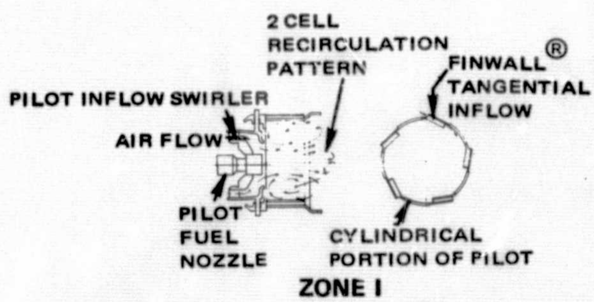


Figure 5 Staged Premix Combustor Rig Liner, End View





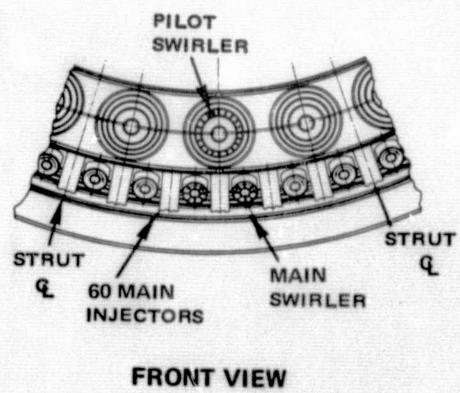
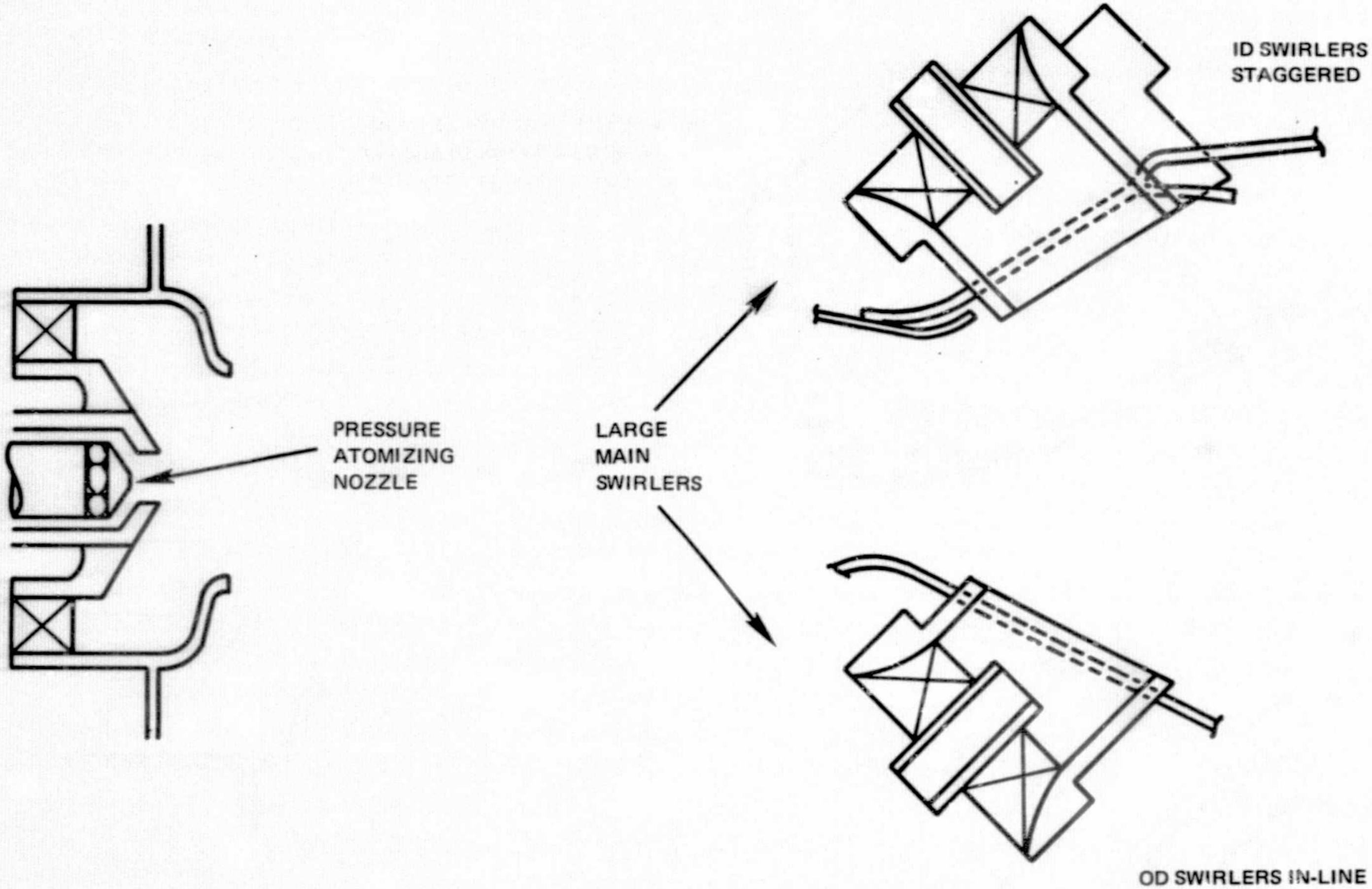


Figure 6a Swirl Vorbix Combustor–Baseline Configuration



NOTE: AFT LINER DILUTION AIR HOLES ELIMINATED
WITH INSTALLATION OF LARGE MAIN
SWIRLERS

Figure 6b Swirl Vorbix Combustor–Configuration S-8 Modifications (ref. Figure 6a)

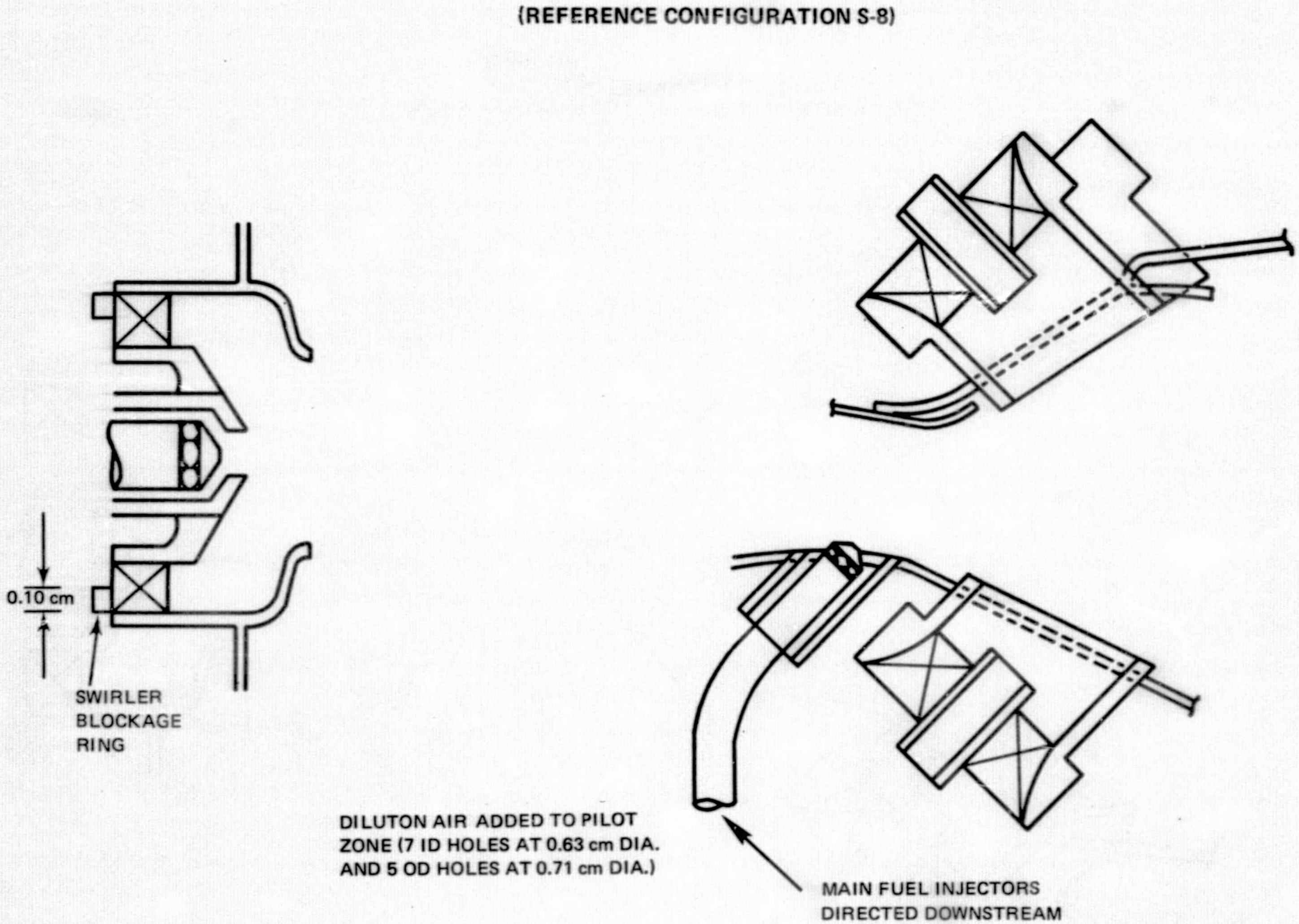


Figure 6c   Swirl Vorbix Combustor–Configuration S-9 Modifications (ref. Figure 6a)

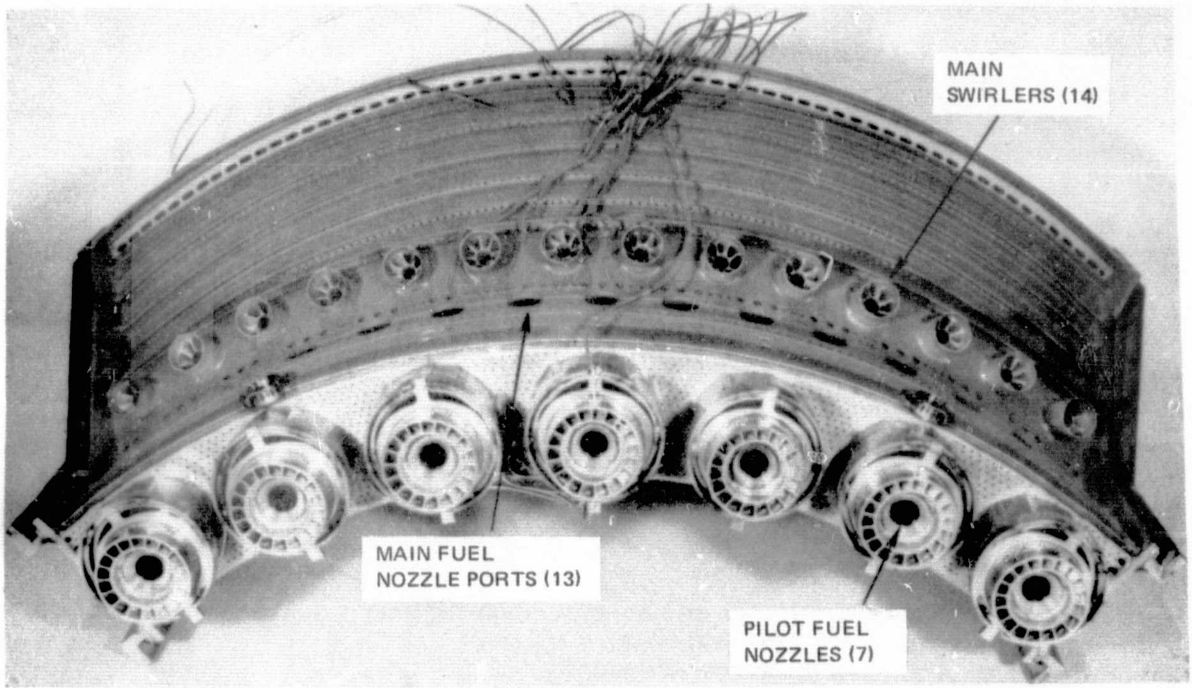
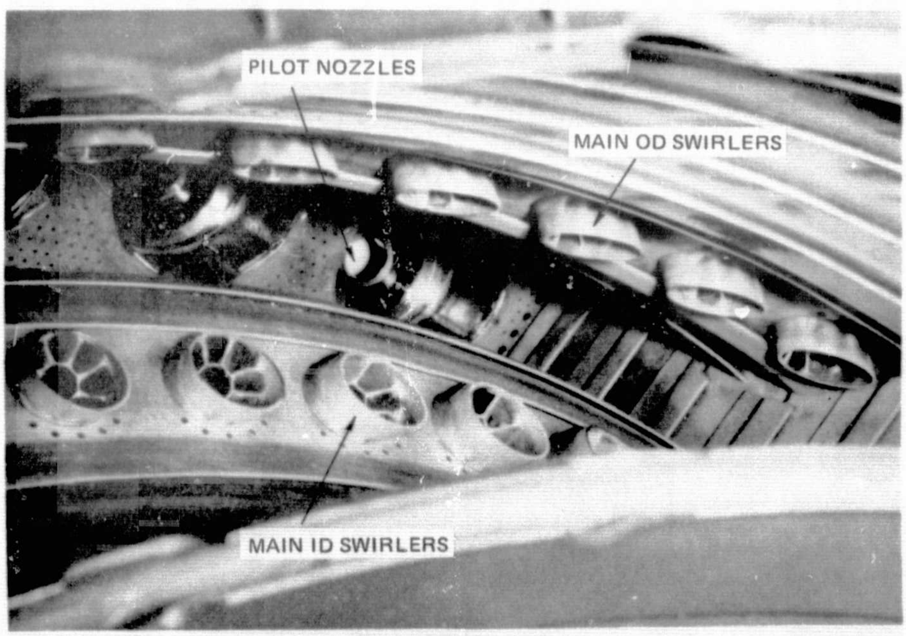


Figure 7 Swirl Vorbix Combustor Rig Liner



UPSTREAM VIEW

Figure 8 Swirl Vorbix Combustor Liner - Closeup

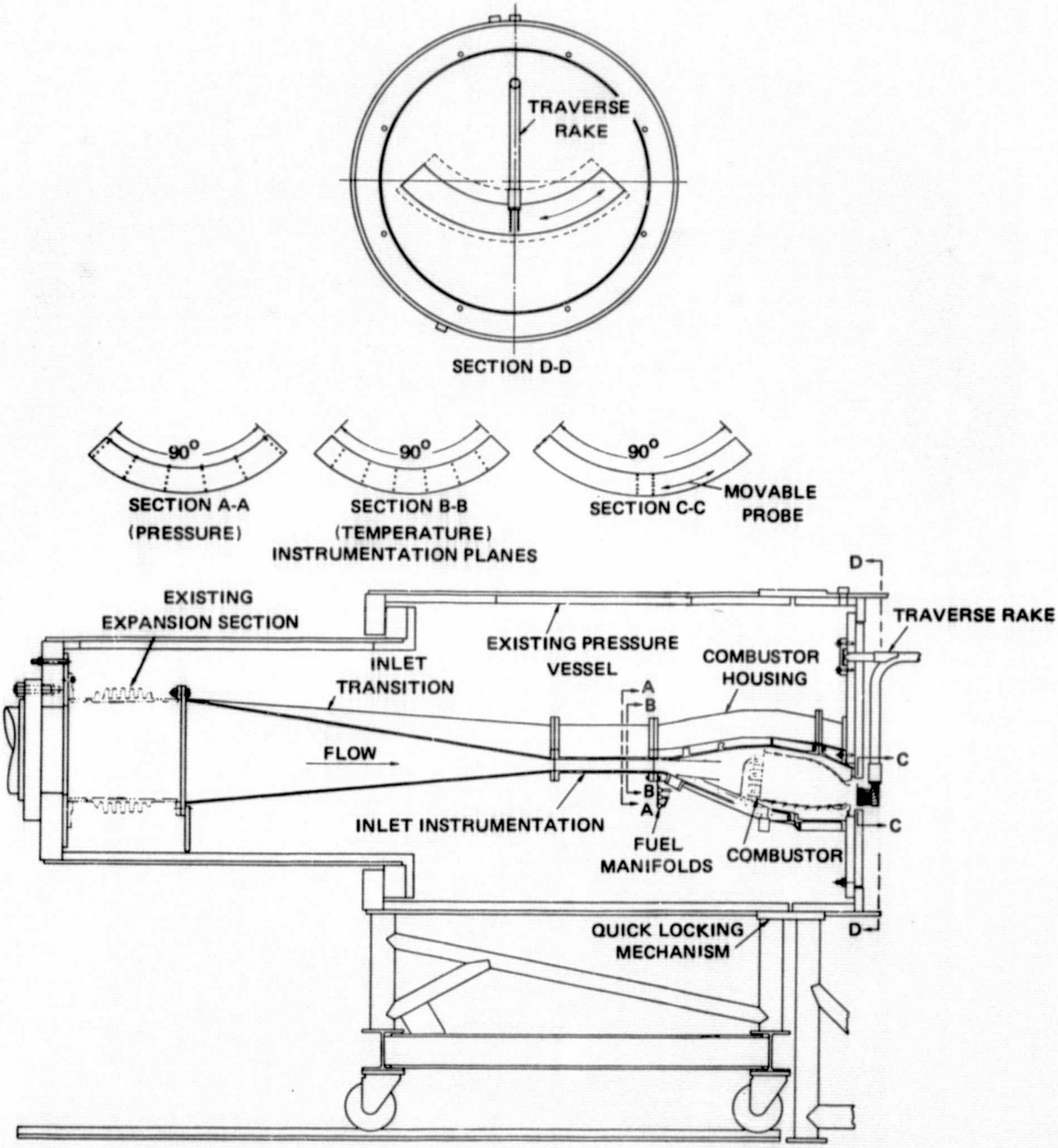


Figure 9 Schematic of Combustor Rig

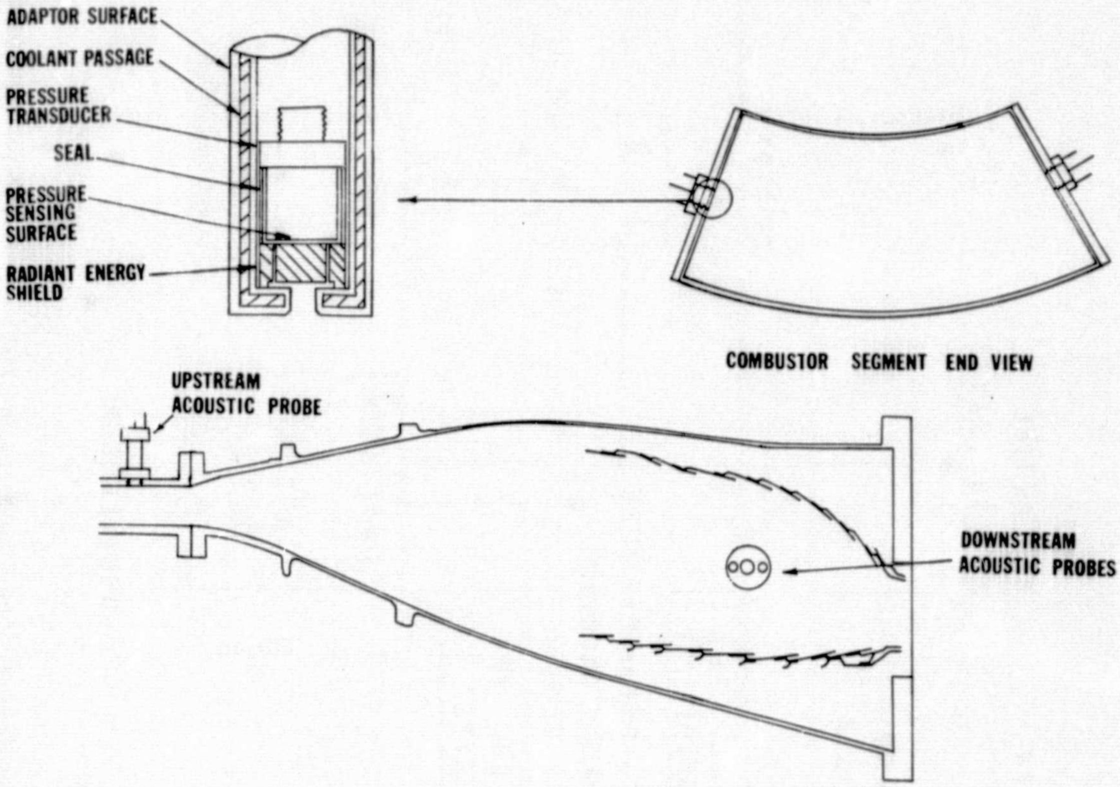


Figure 10 Typical Acoustical Probe Installation in Combustor Rig

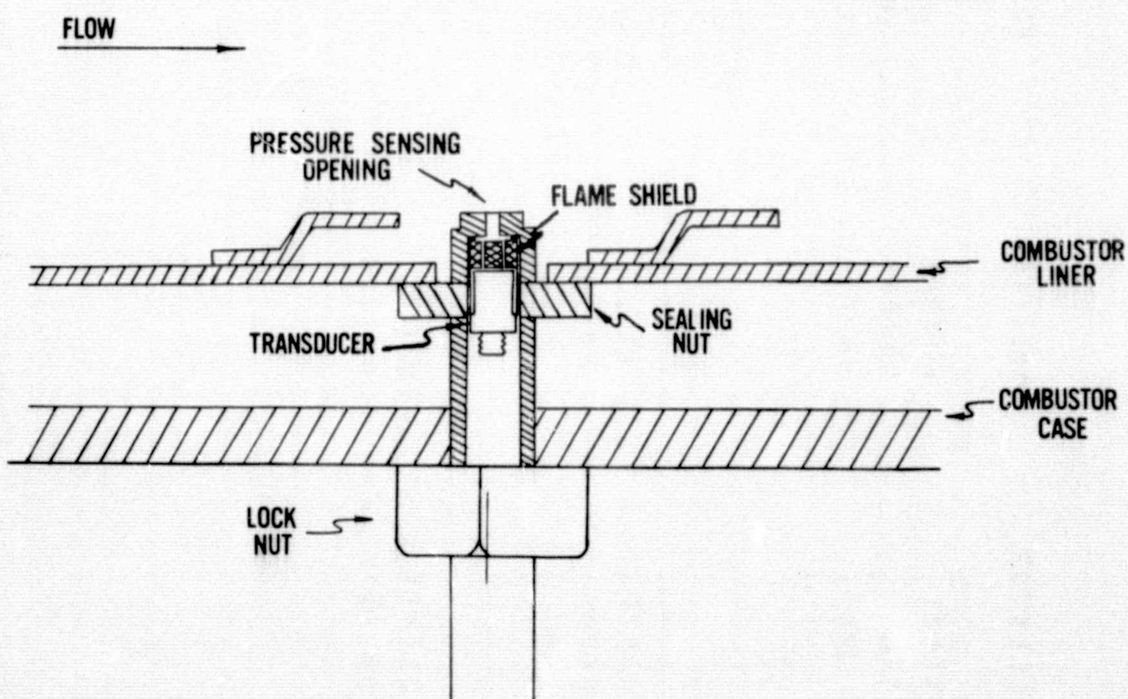


Figure 11 Typical Combustor Microphone Installation

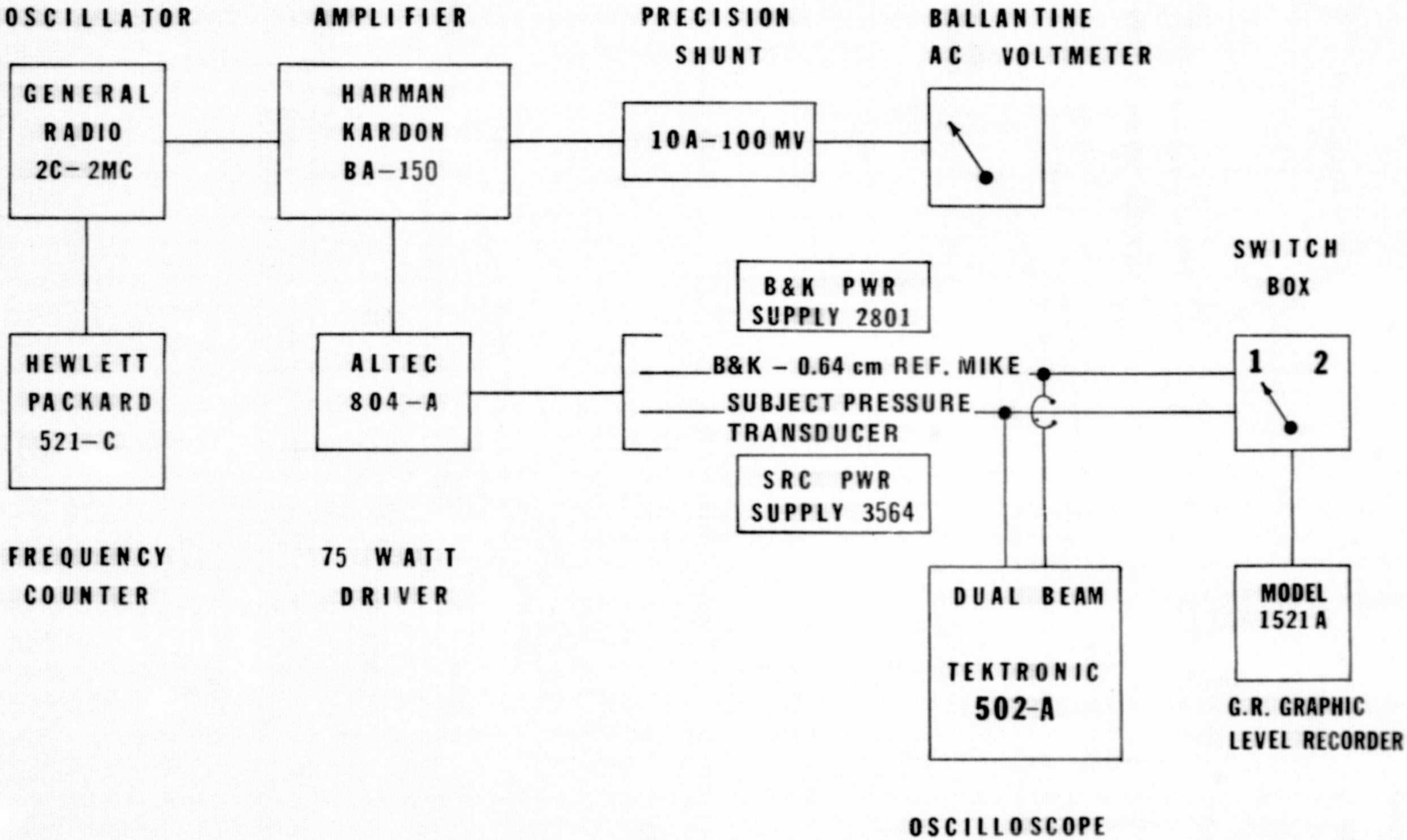
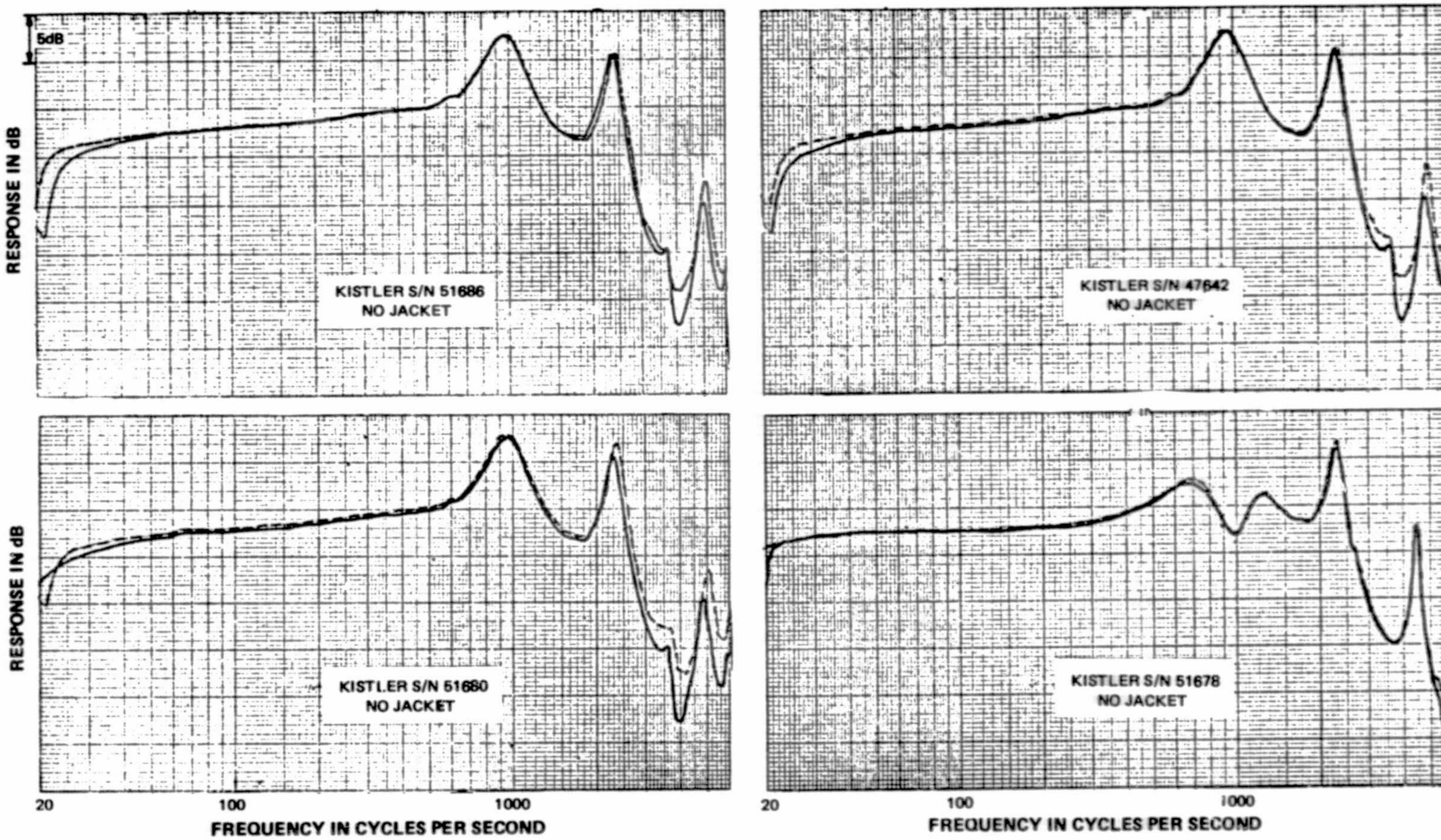


Figure 12 P&WA Dynamic Pressure Transducer Transfer Calibration System



B&K 0.64 cm MICROPHONE MODEL 4136 S/N 304603

KISTLER PRESSURE TRANSDUCER MODEL 603A1

Figure 13 Pressure Transducer Relative Frequency Response

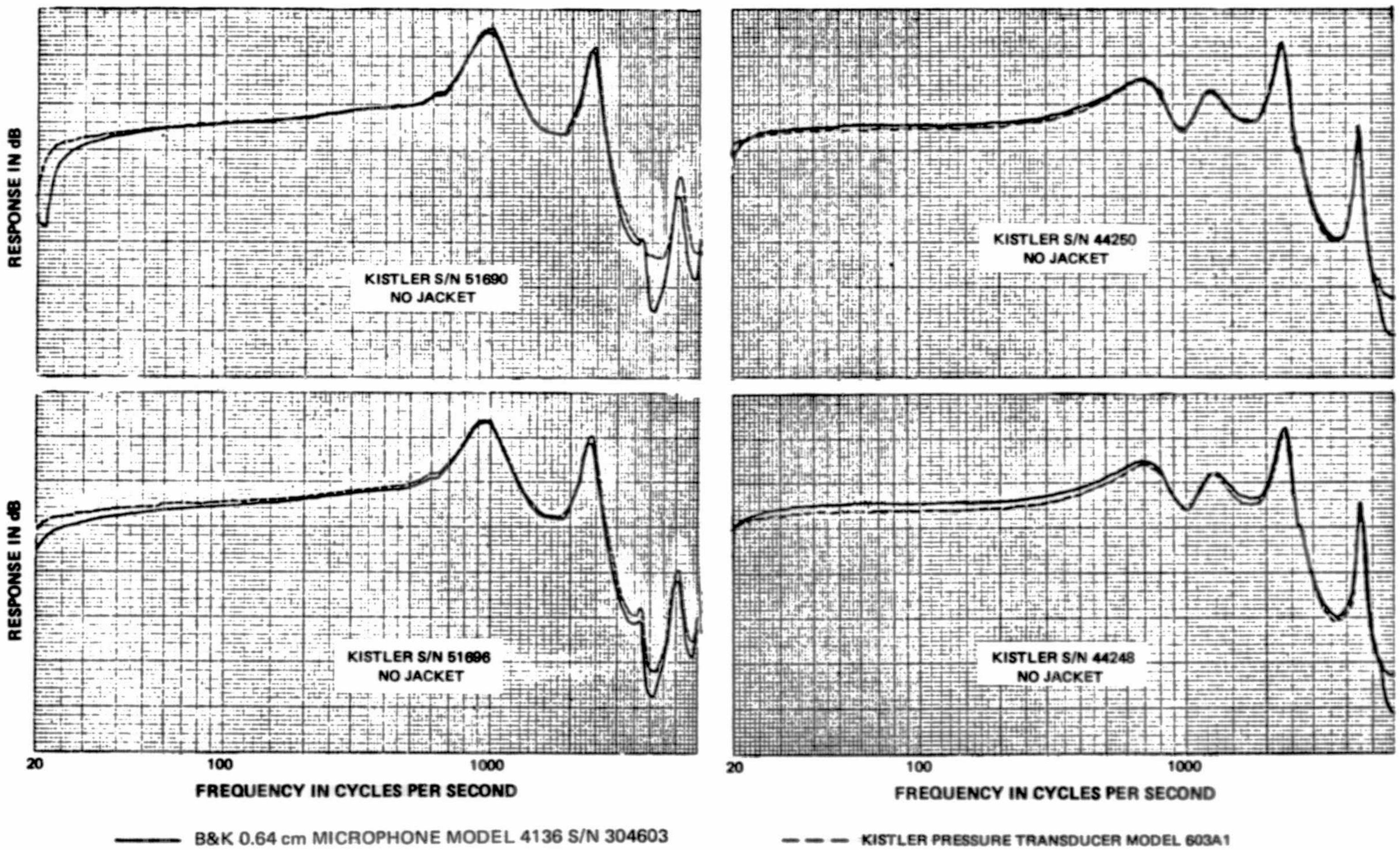


Figure 14 Pressure Transducer Relative Frequency Response

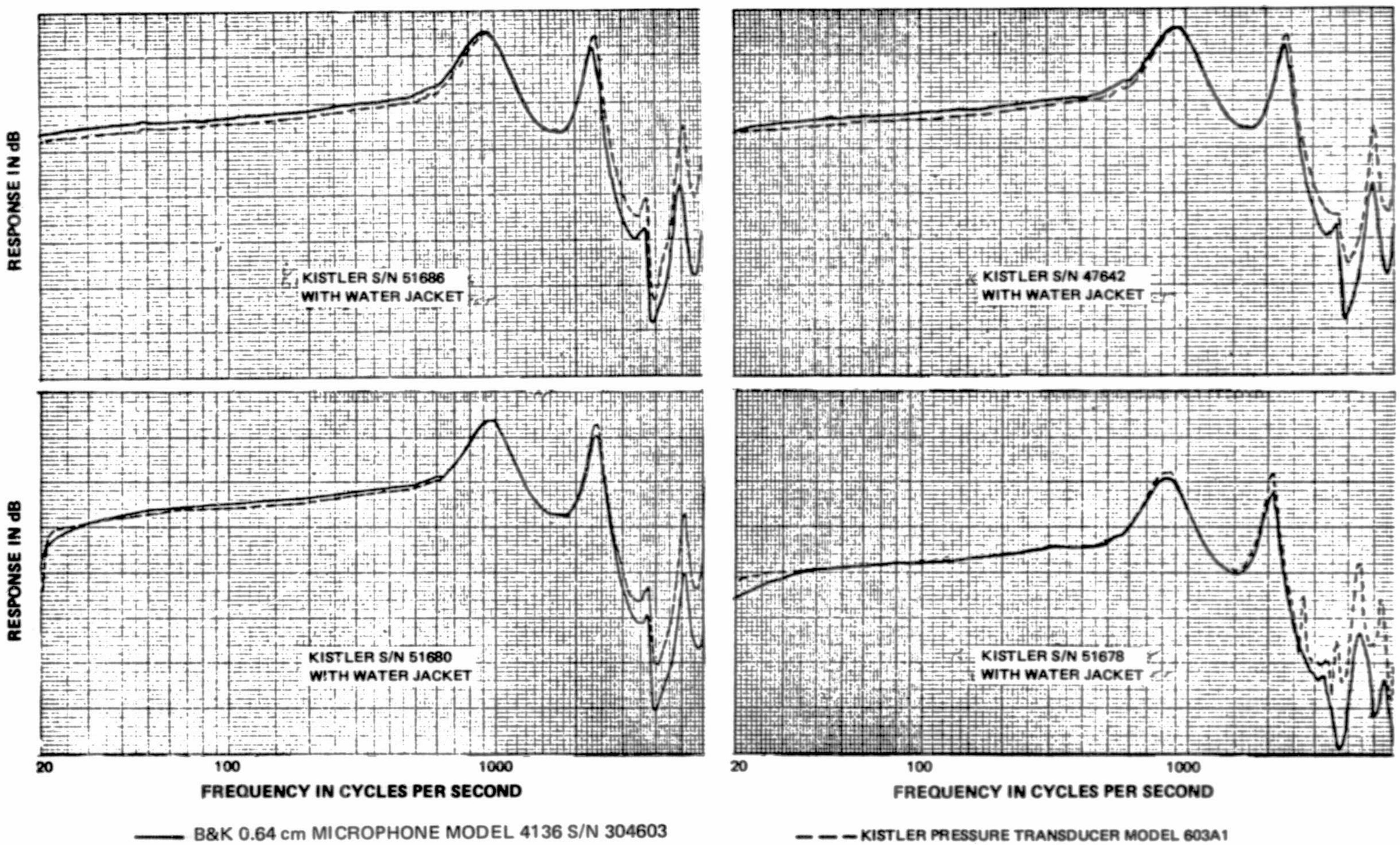


Figure 15 Pressure Transducer Relative Frequency Response

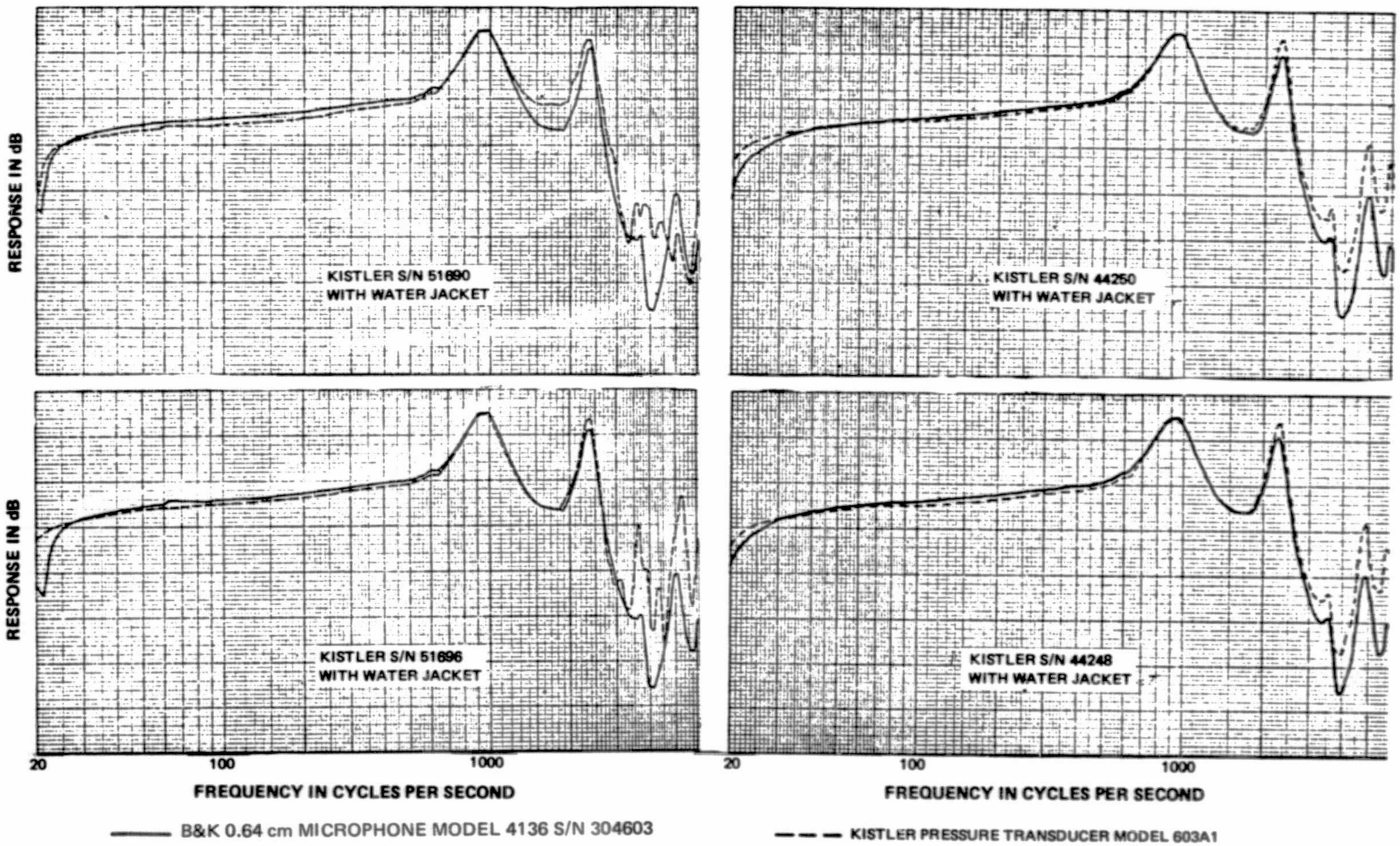


Figure 16 Pressure Transducer Relative Frequency Response

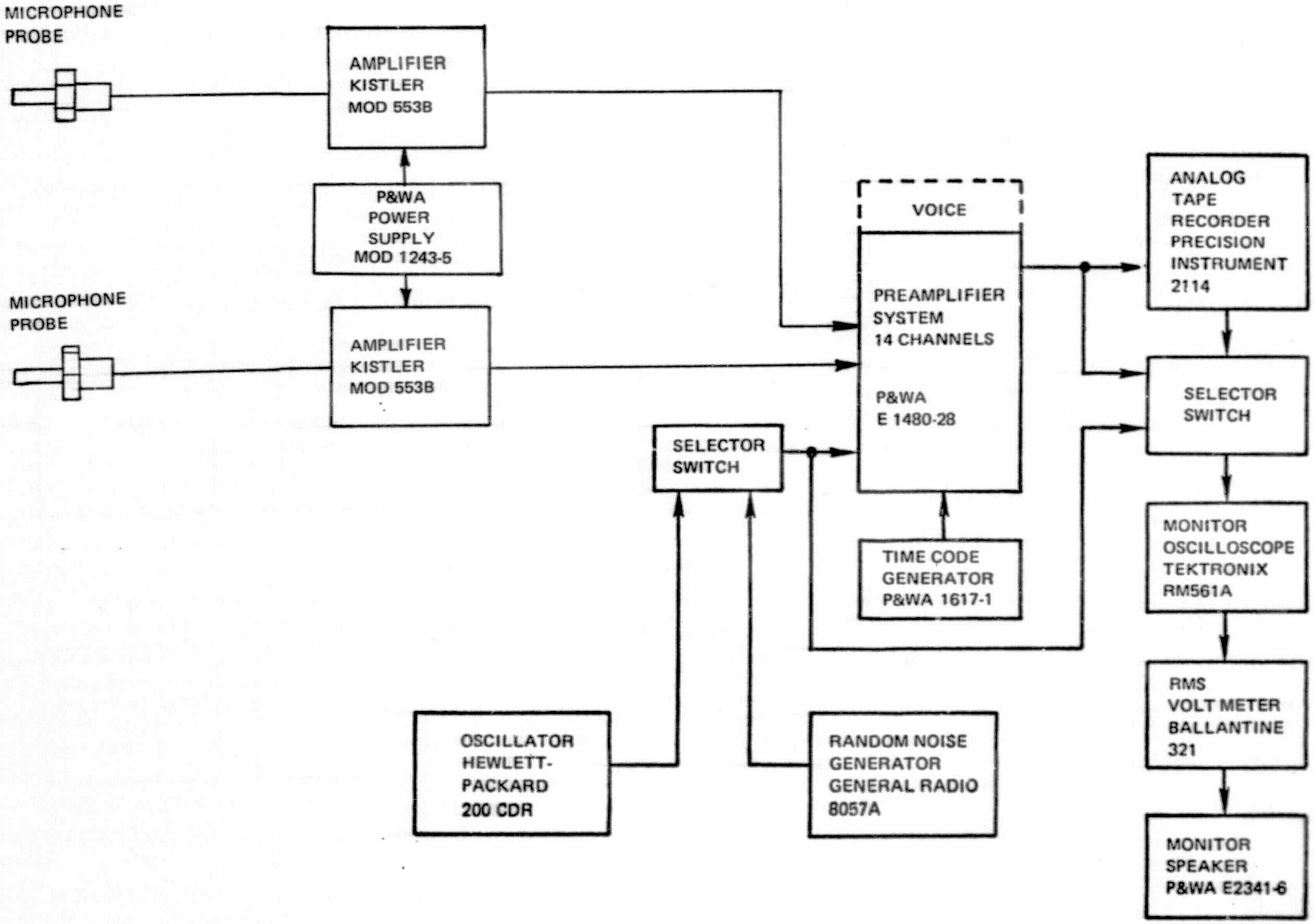


Figure 17 P&WA Combustor Noise Recording System

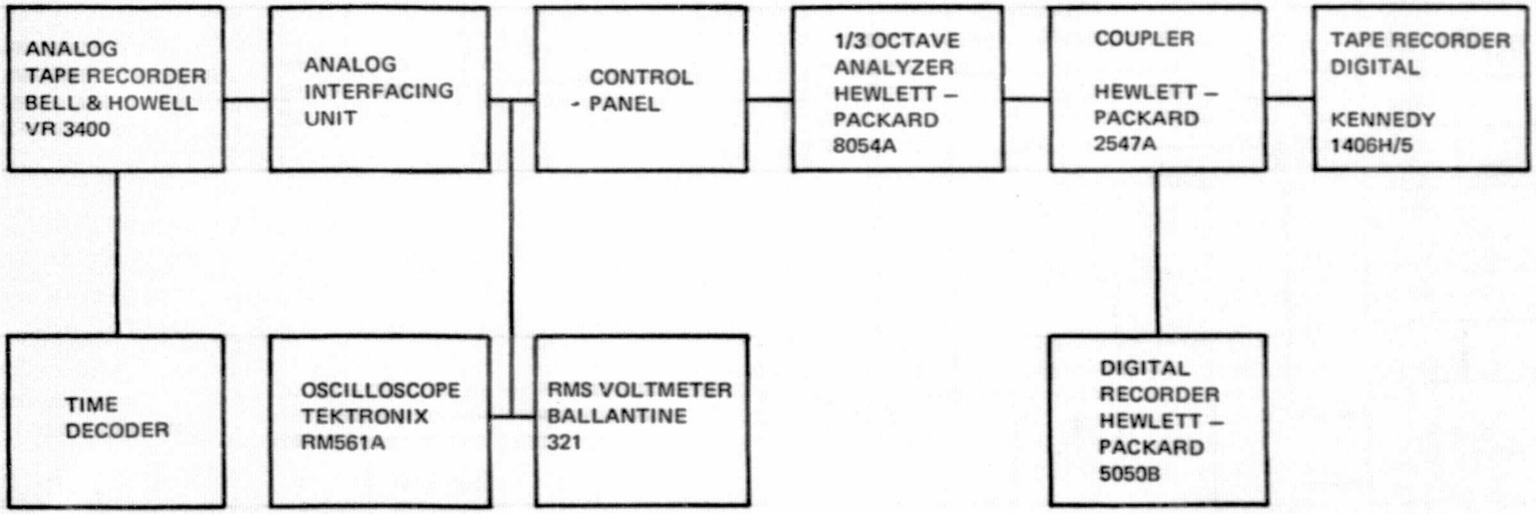


Figure 18 P&WA 1/3 Octave Band Sound Analysis System

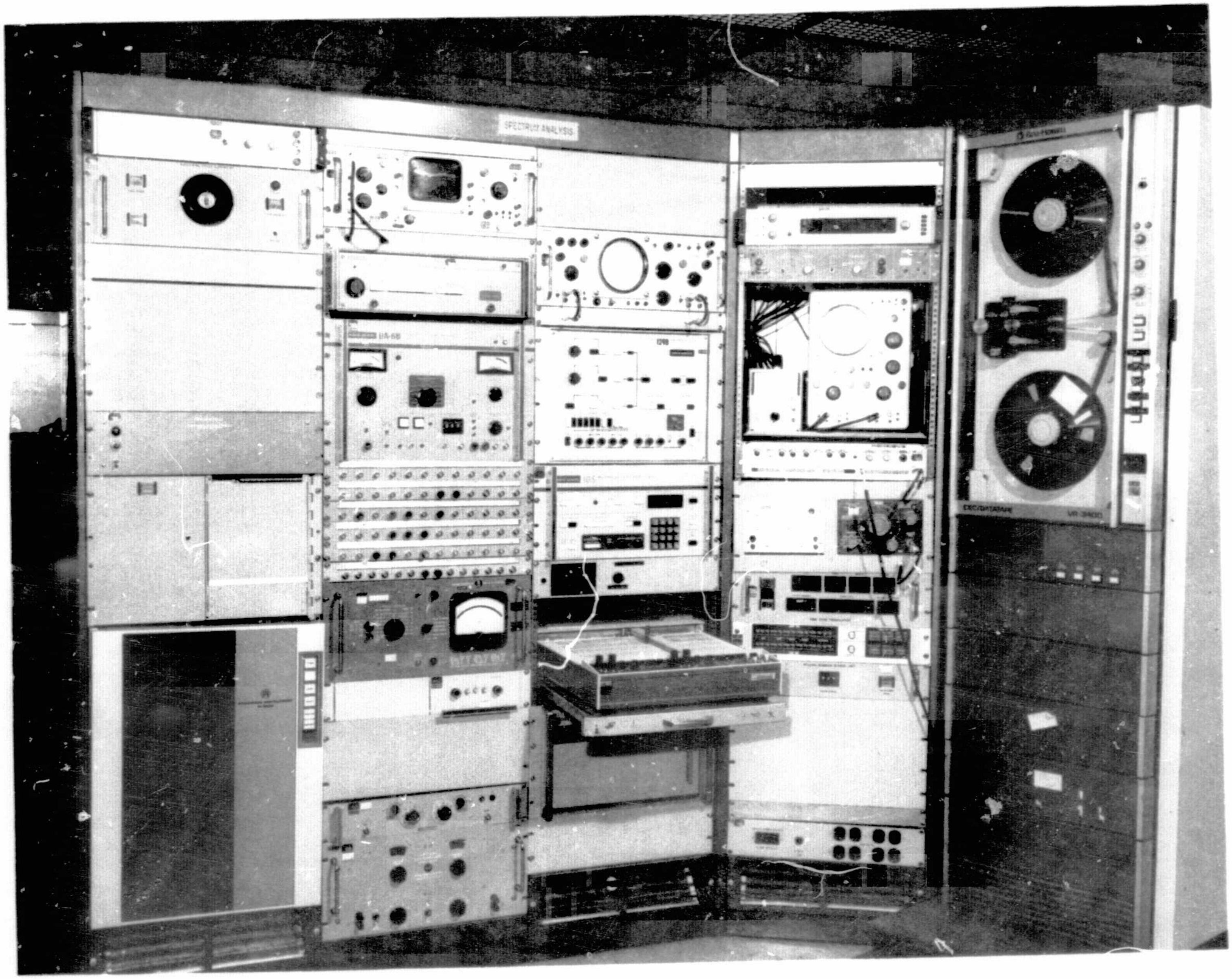


Figure 19 High Speed Spectral Analysis System

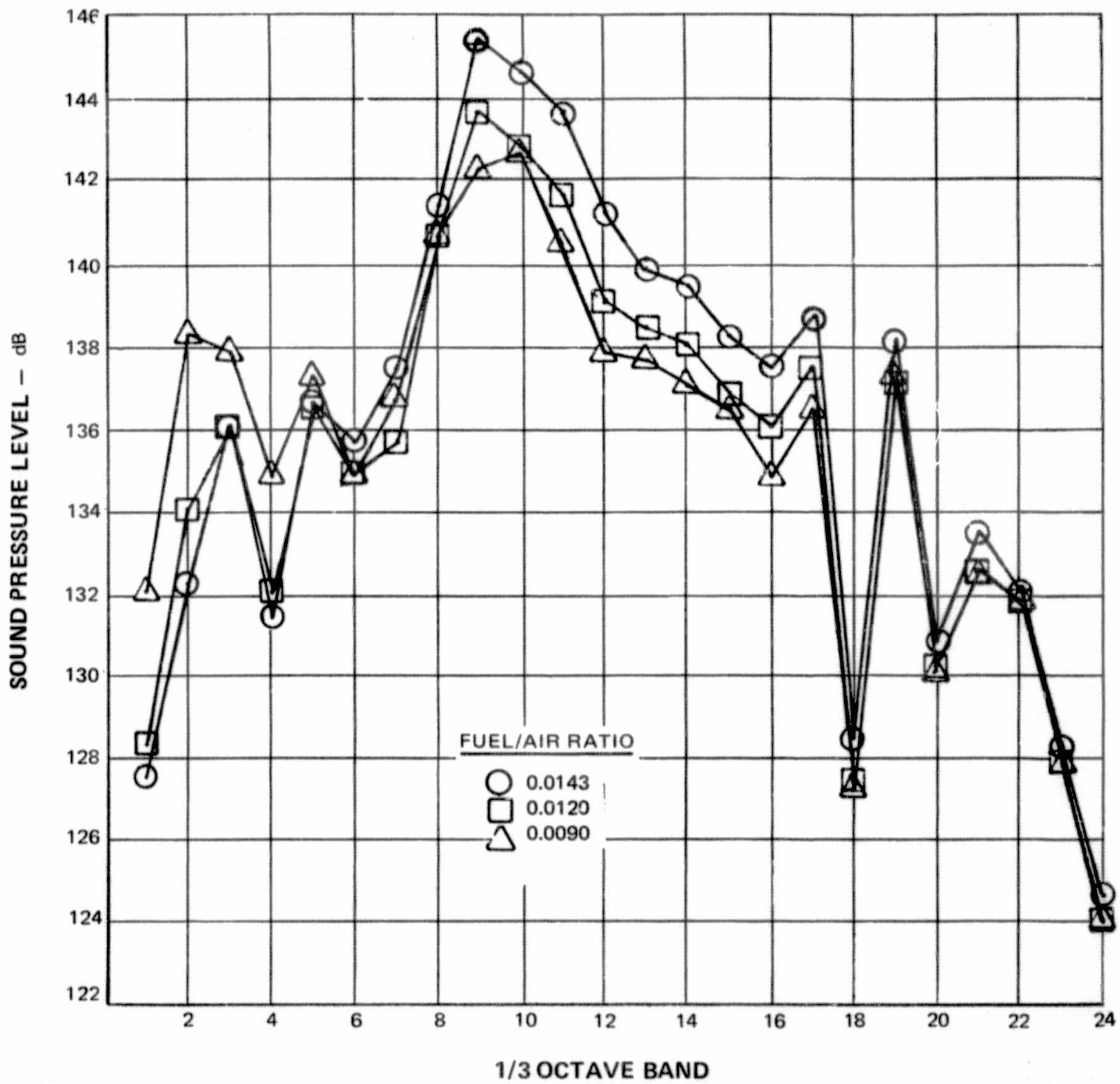


Figure 20 Sensitivity of Configuration N-8 to Fuel-Air Ratio–Idle, Hot

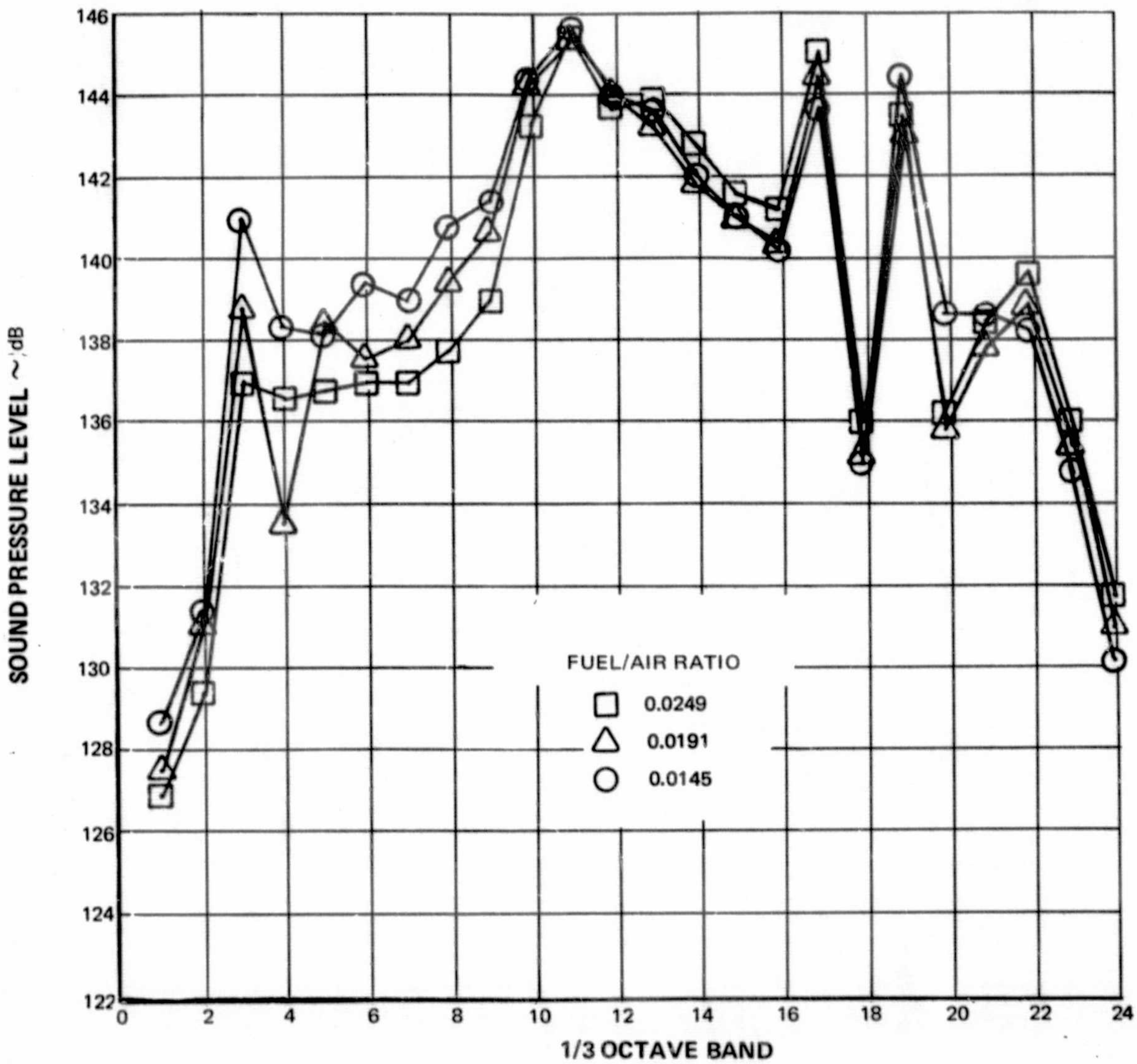


Figure 21 Sensitivity of Configuration N-8 to Fuel-Air Ratio–SLTO, Hot

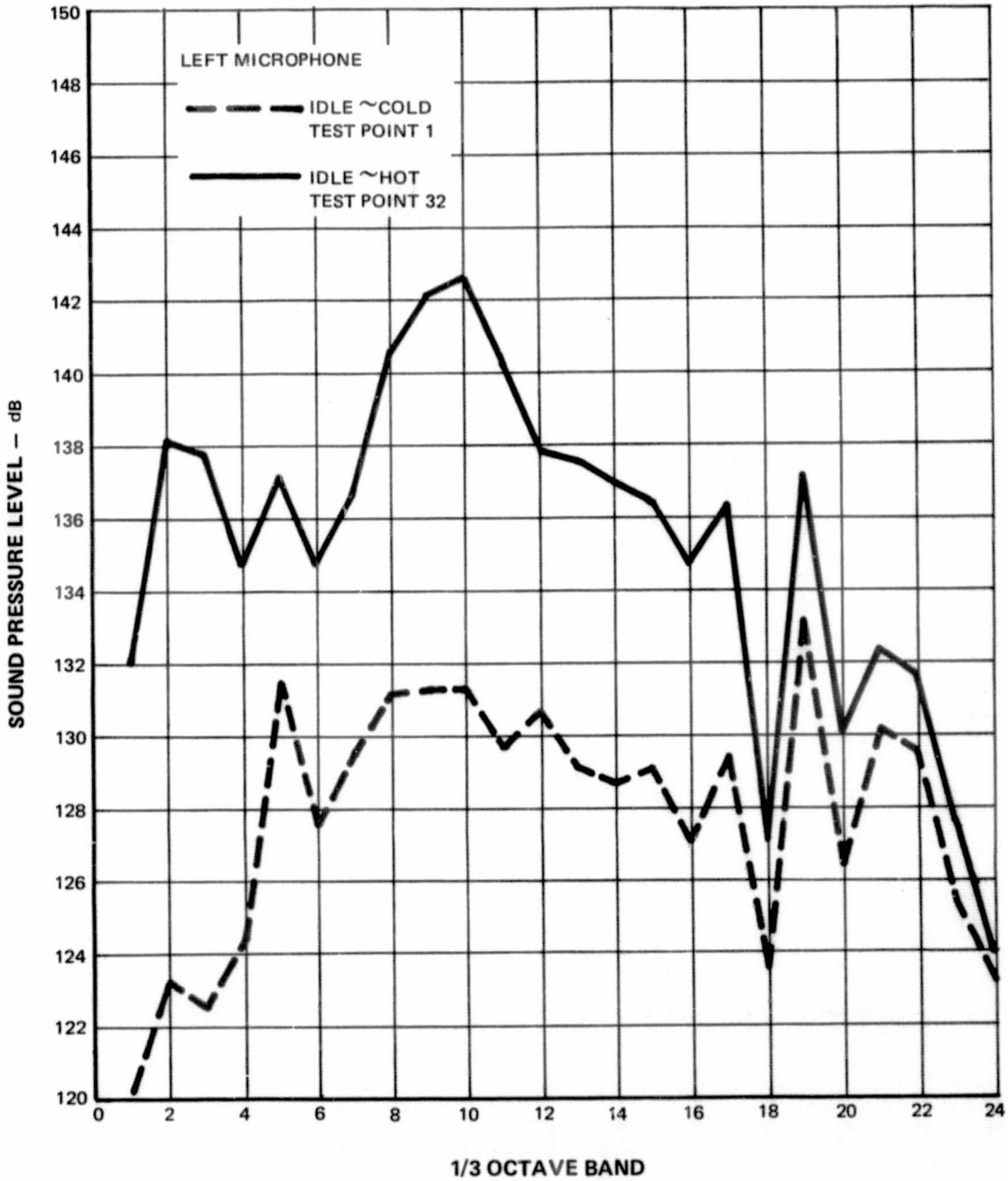


Figure 22a Third Octave Band Spectra for Configuration N-8 – Idle

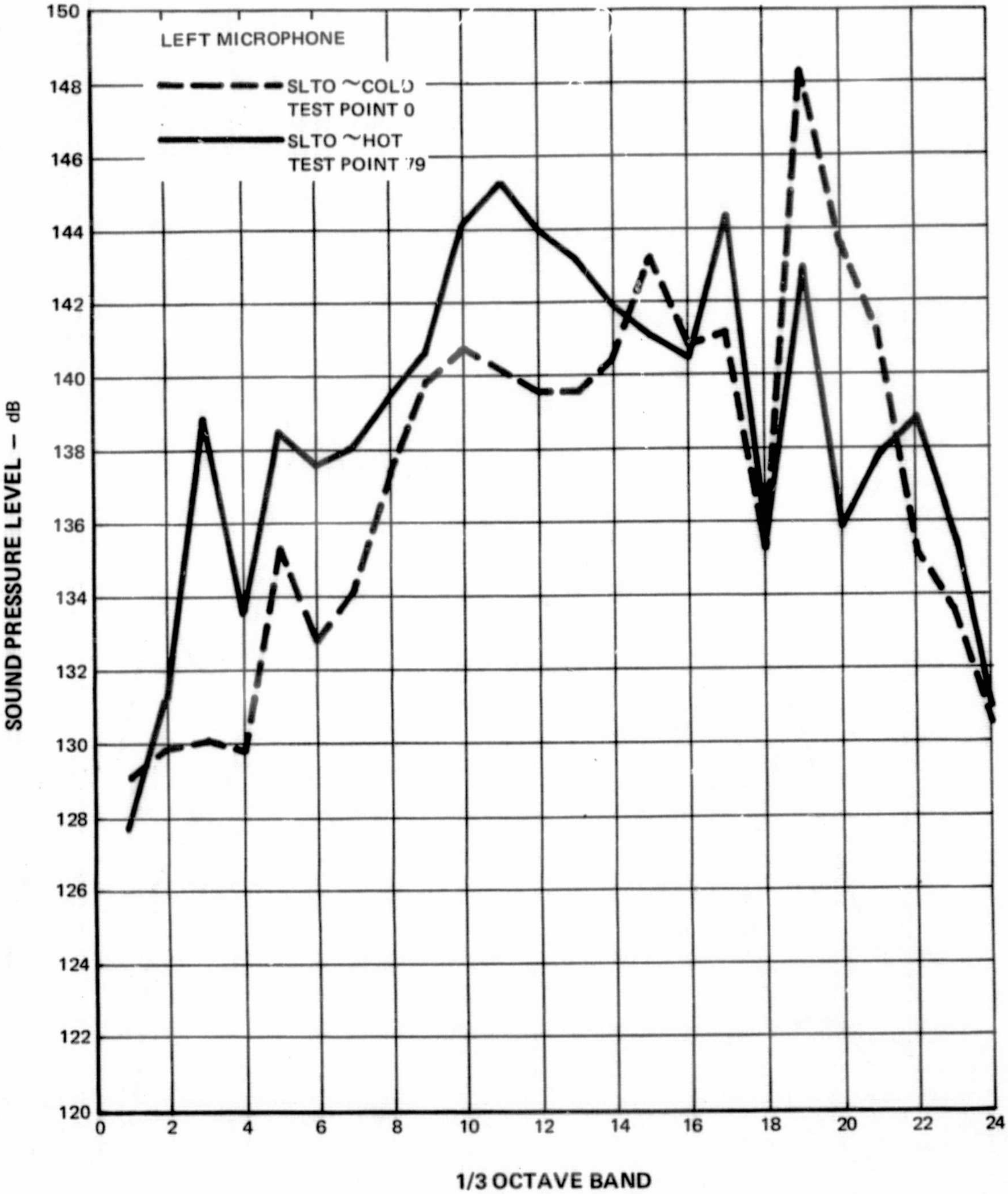


Figure 22b Third Octave Band Spectra for Configuration N-8 – SLTO

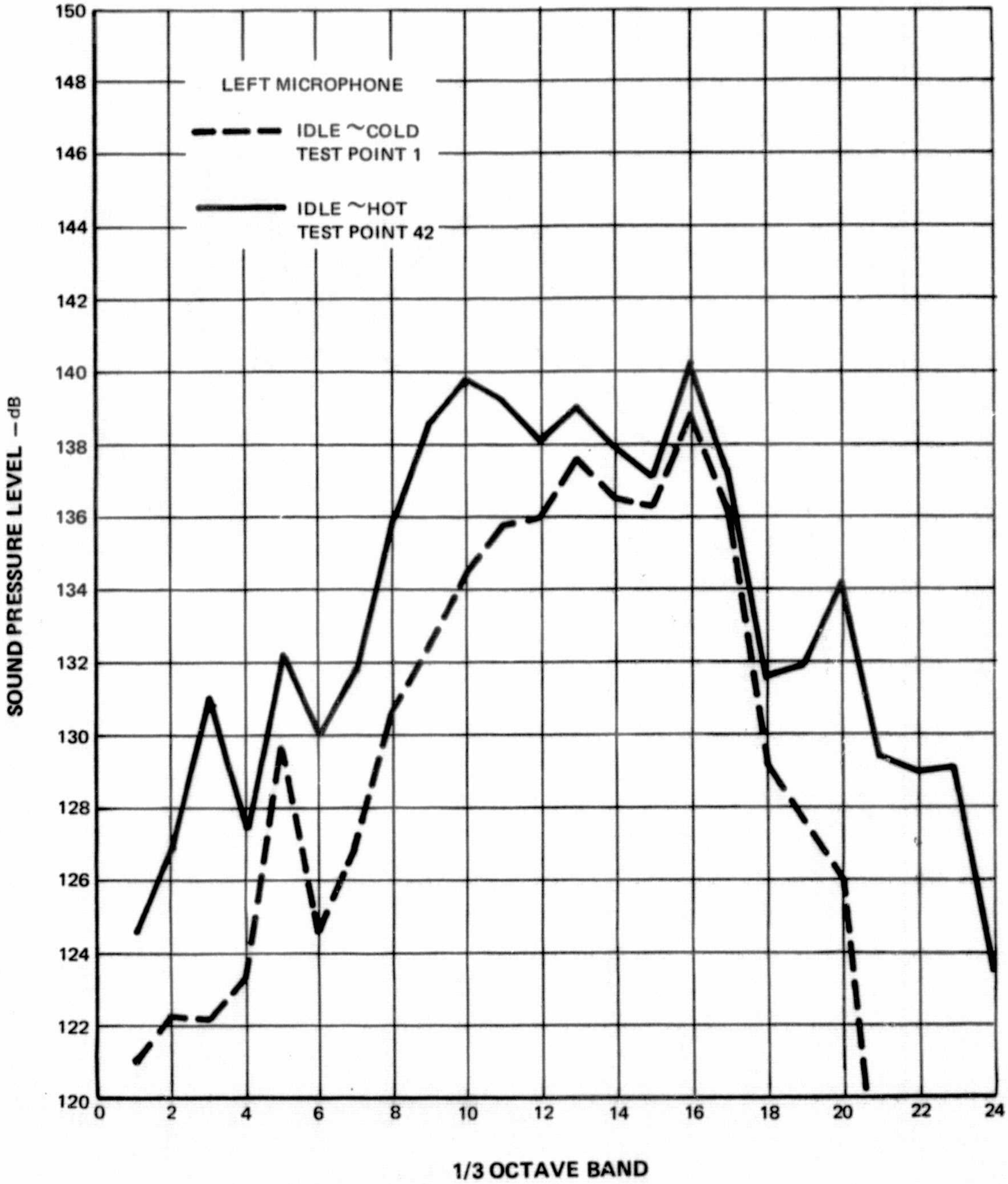


Figure 23a Third Octave Band Spectra for Configuration N-9 – Idle

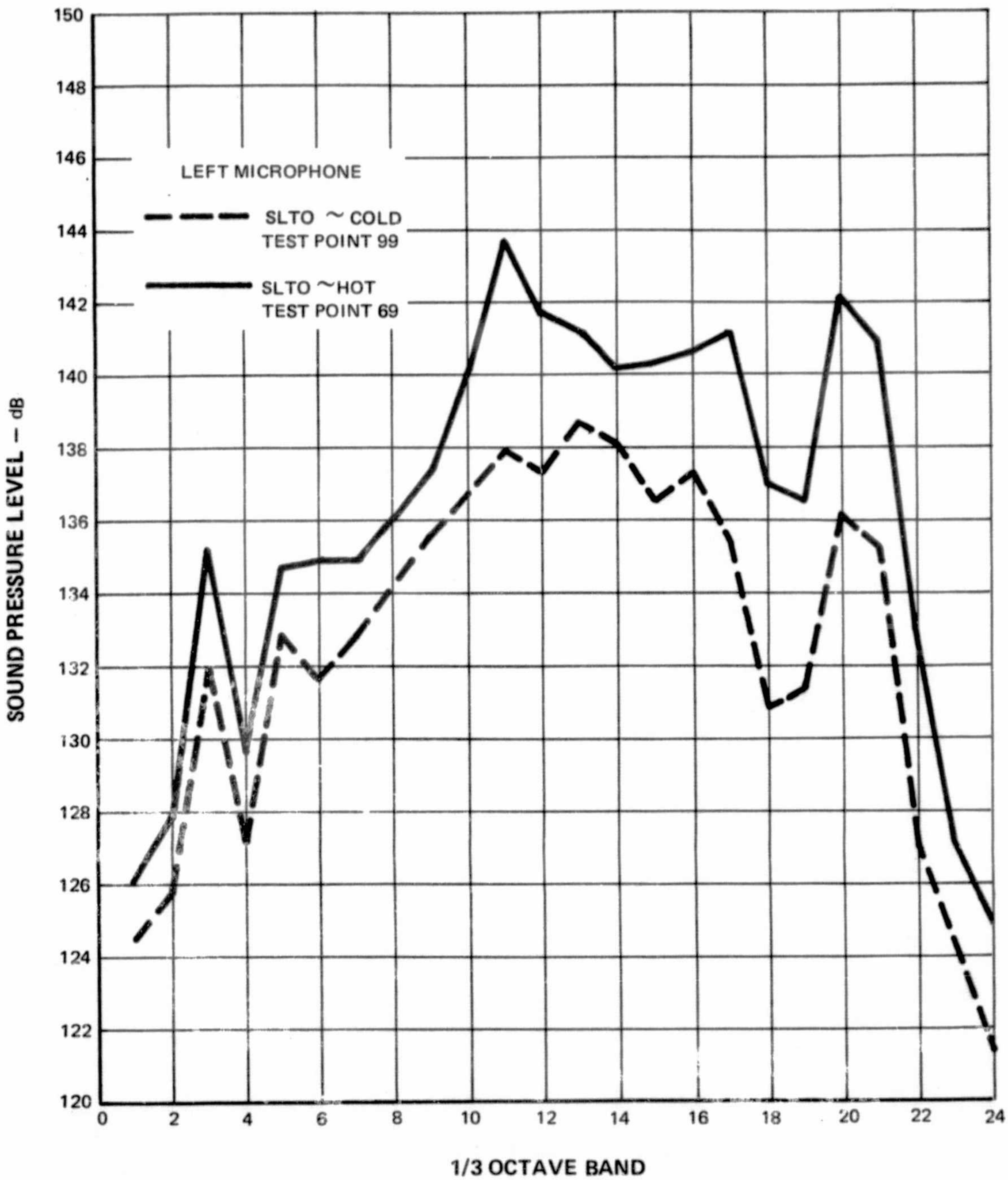


Figure 23b Third Octave Band Spectra for Configuration N-9–SLTO

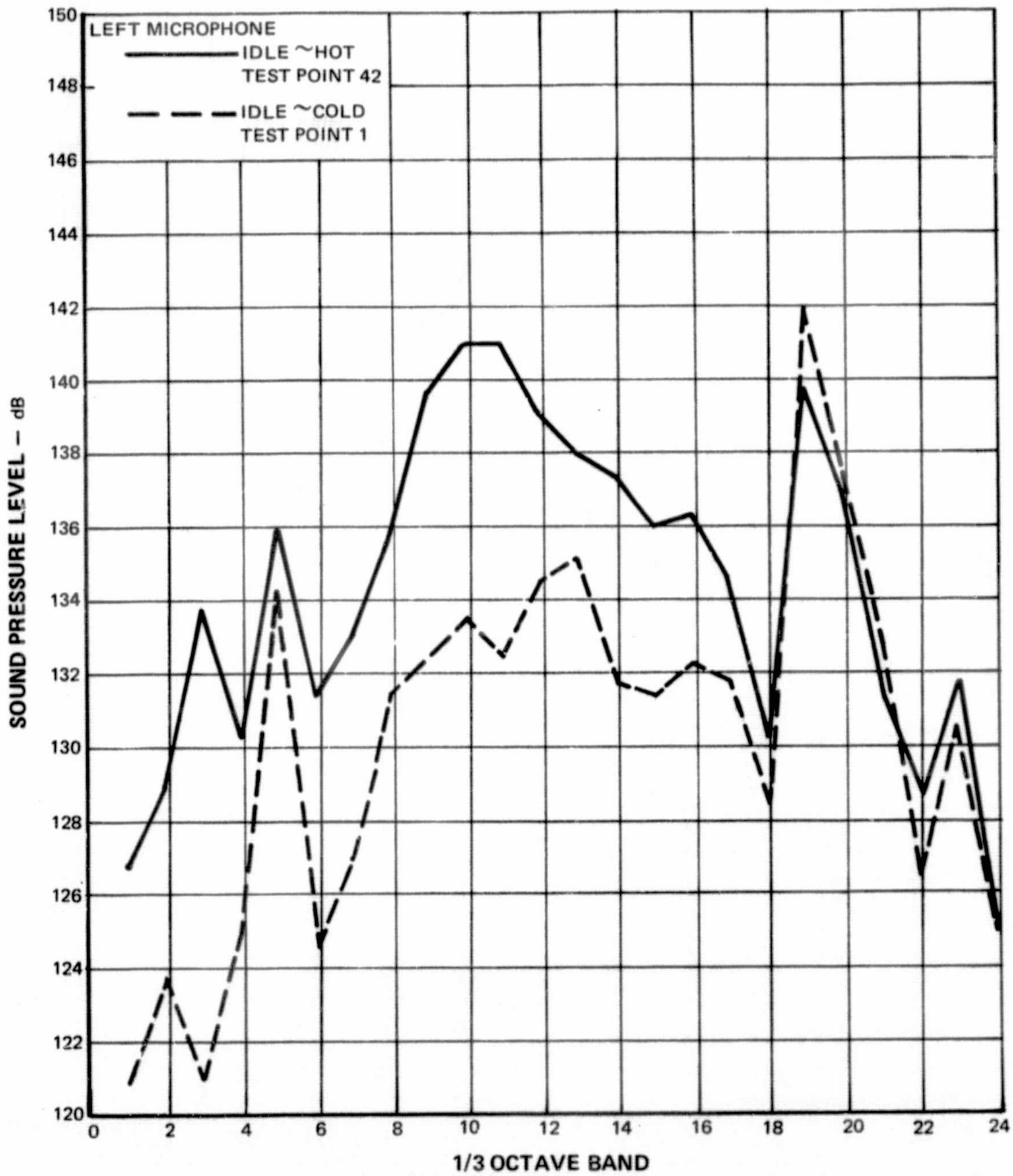


Figure 24a Third Octave Band Spectra for Configuration N-10 – Idle

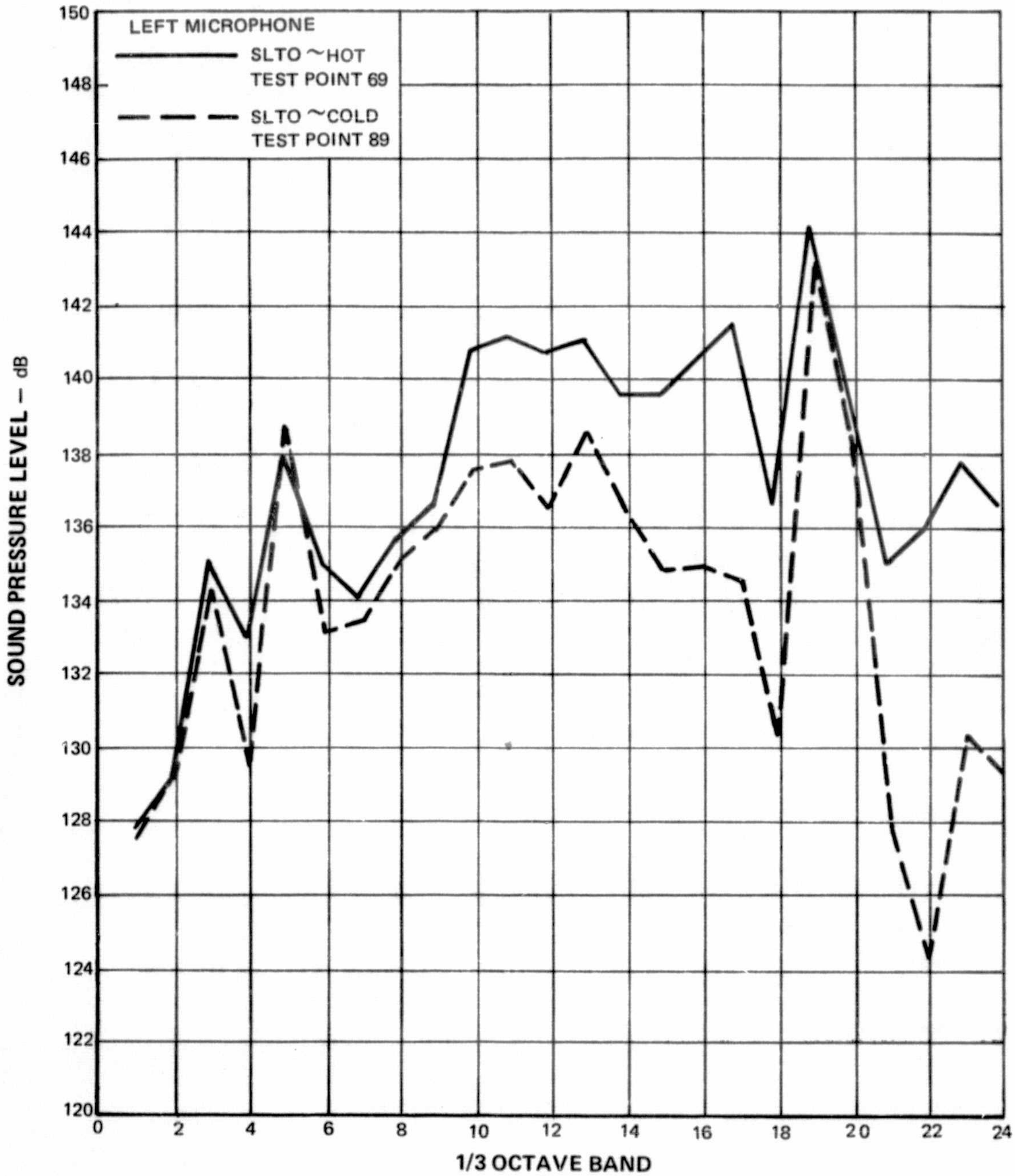


Figure 24b Third Octave Band Spectra for Configuration N-10 – SLTO

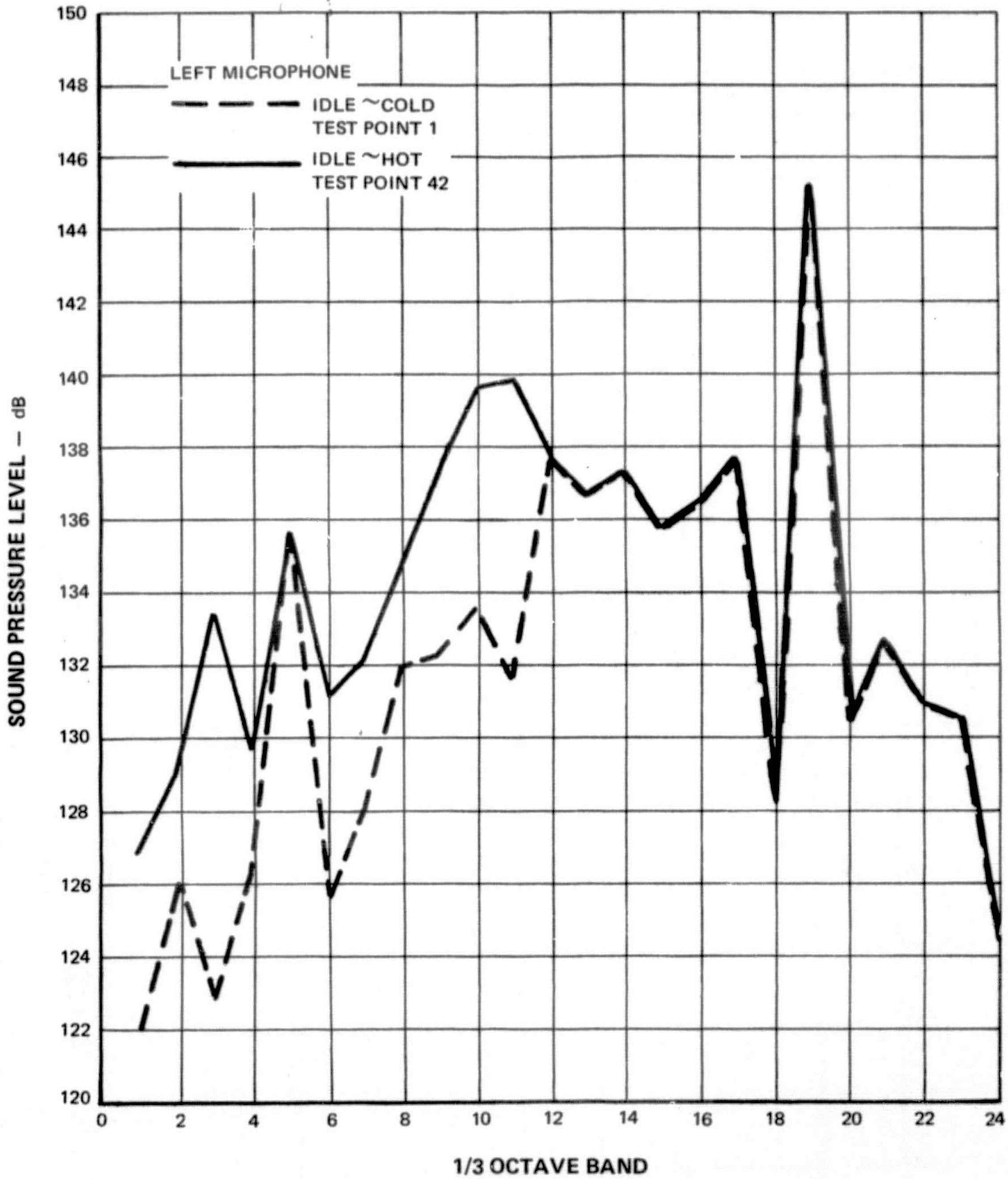


Figure 25a Third Octave Band Spectra for Configuration N-11 – Idle

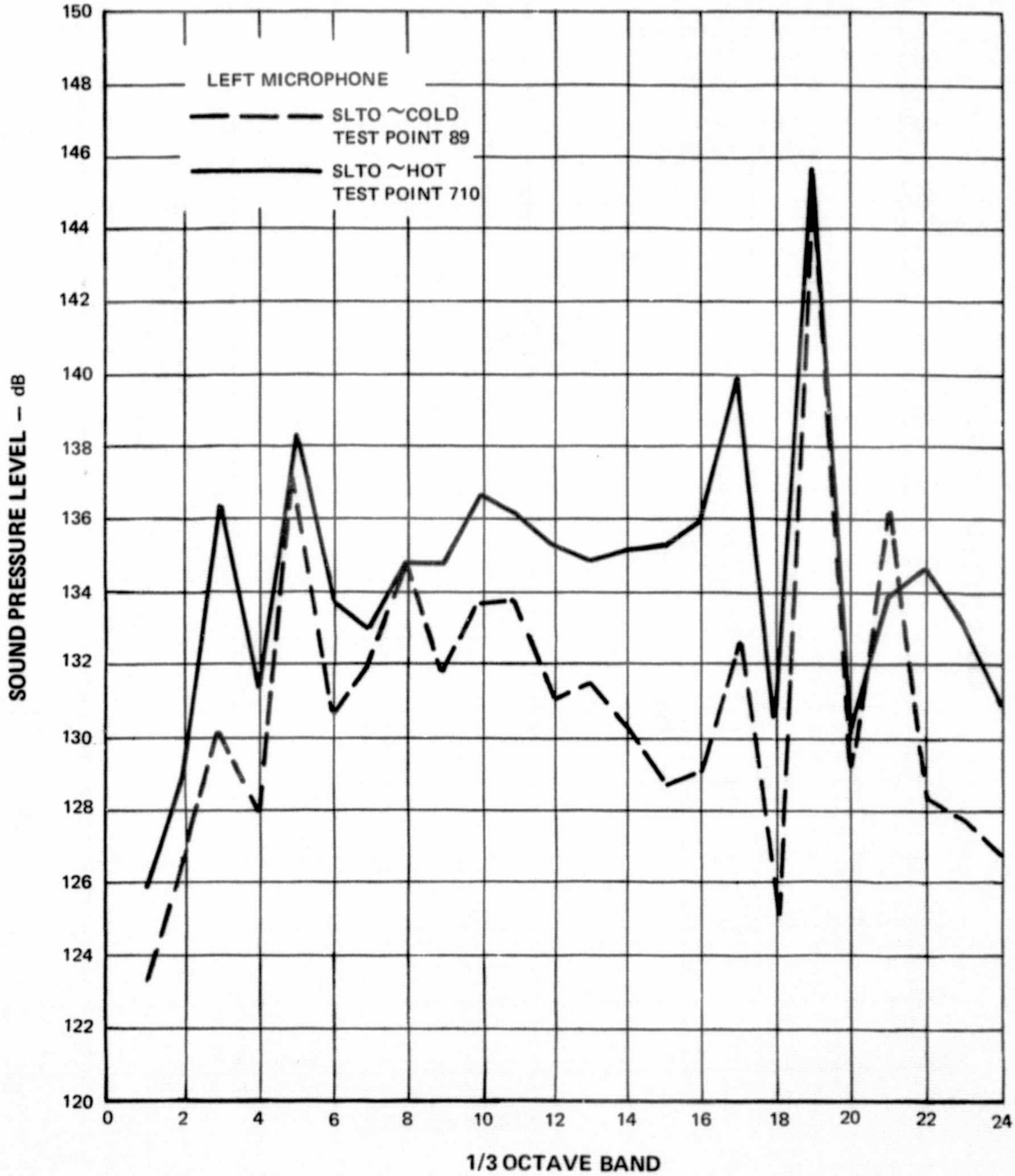


Figure 25b Third Octave Band Spectra for Configuration N-11 – SLTO

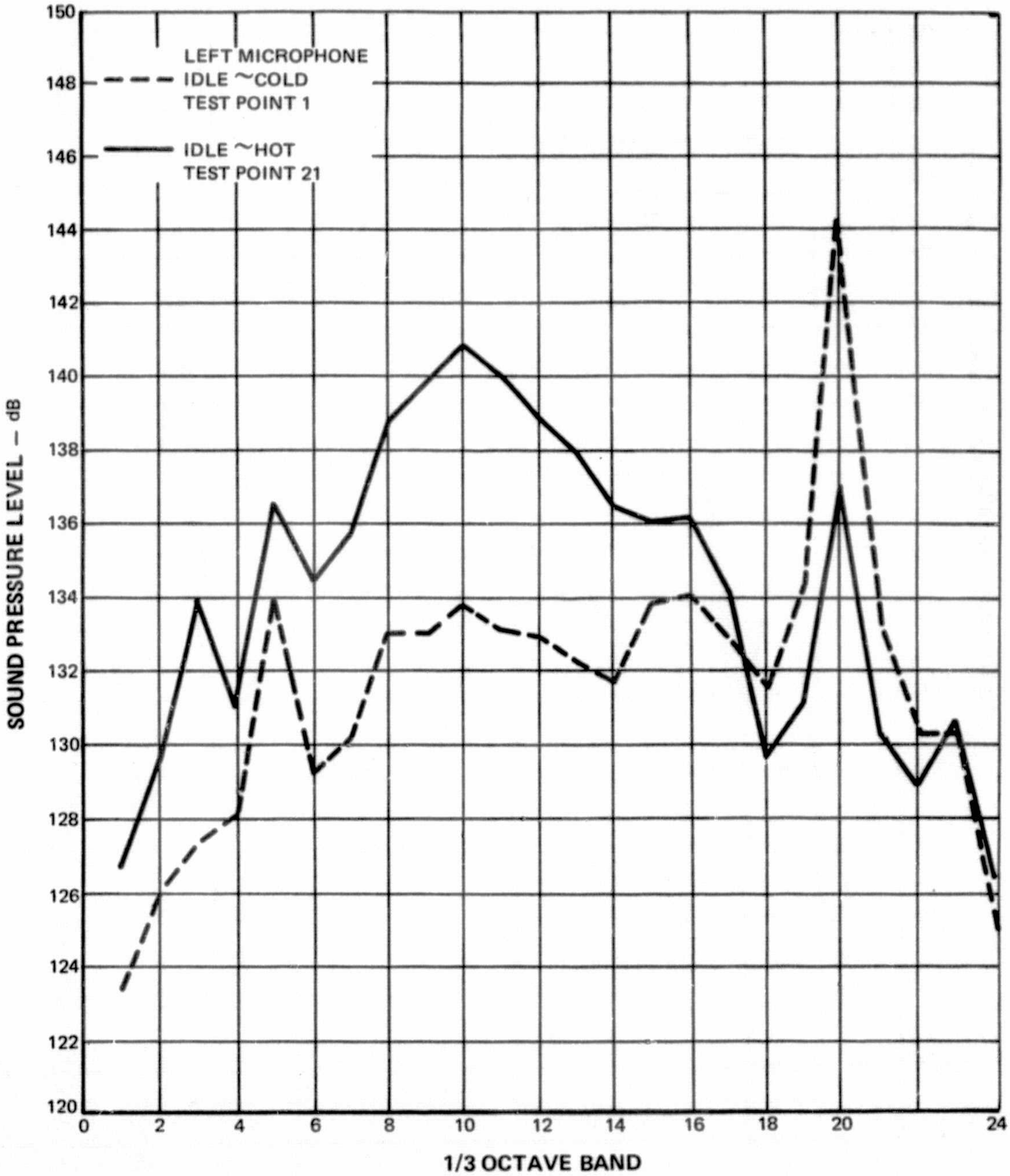


Figure 26a Third Octave Band Spectra for Configuration N-12 – Idle

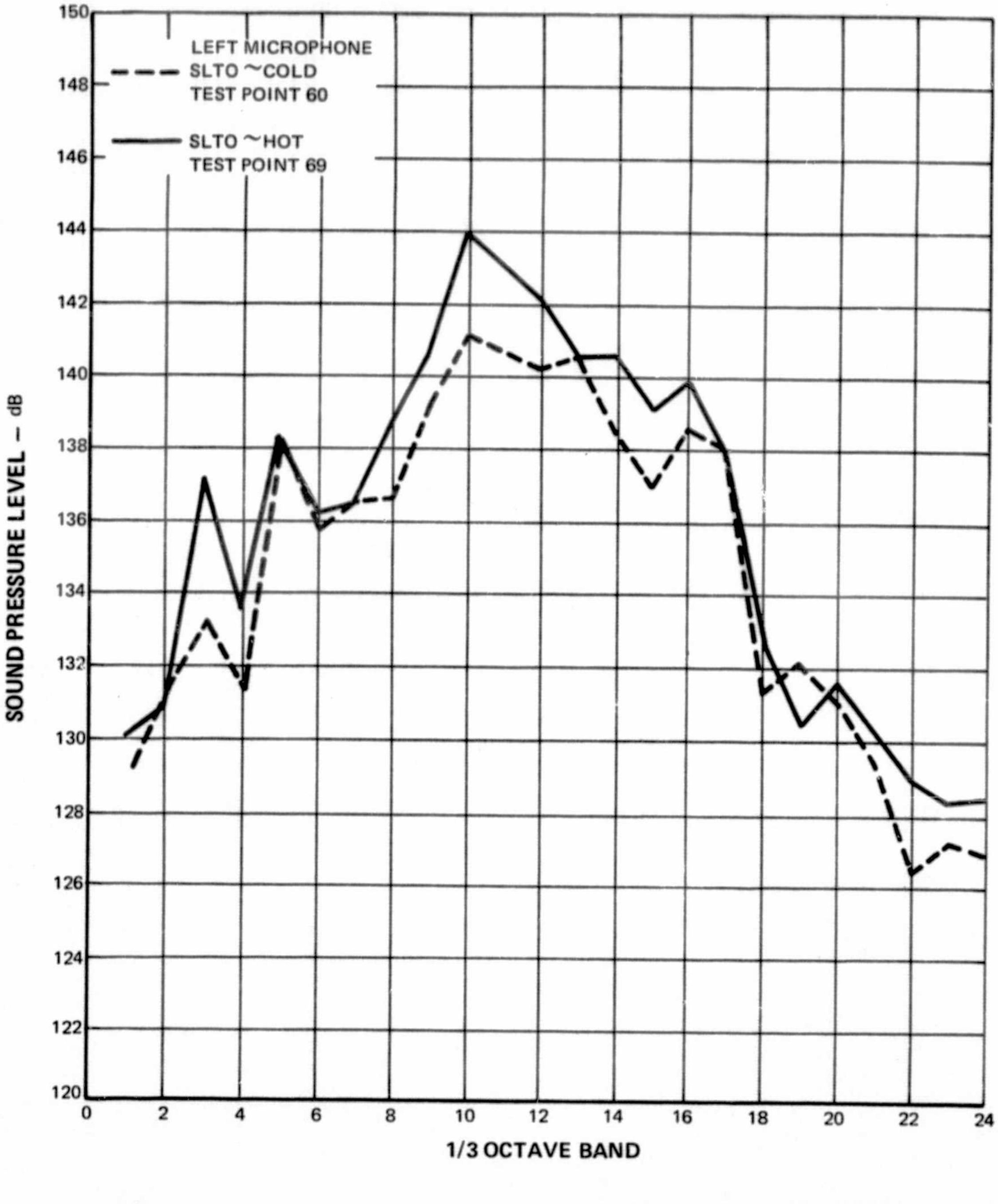


Figure 26b Third Octave Band Spectra for Configuration N-12 – SLTO

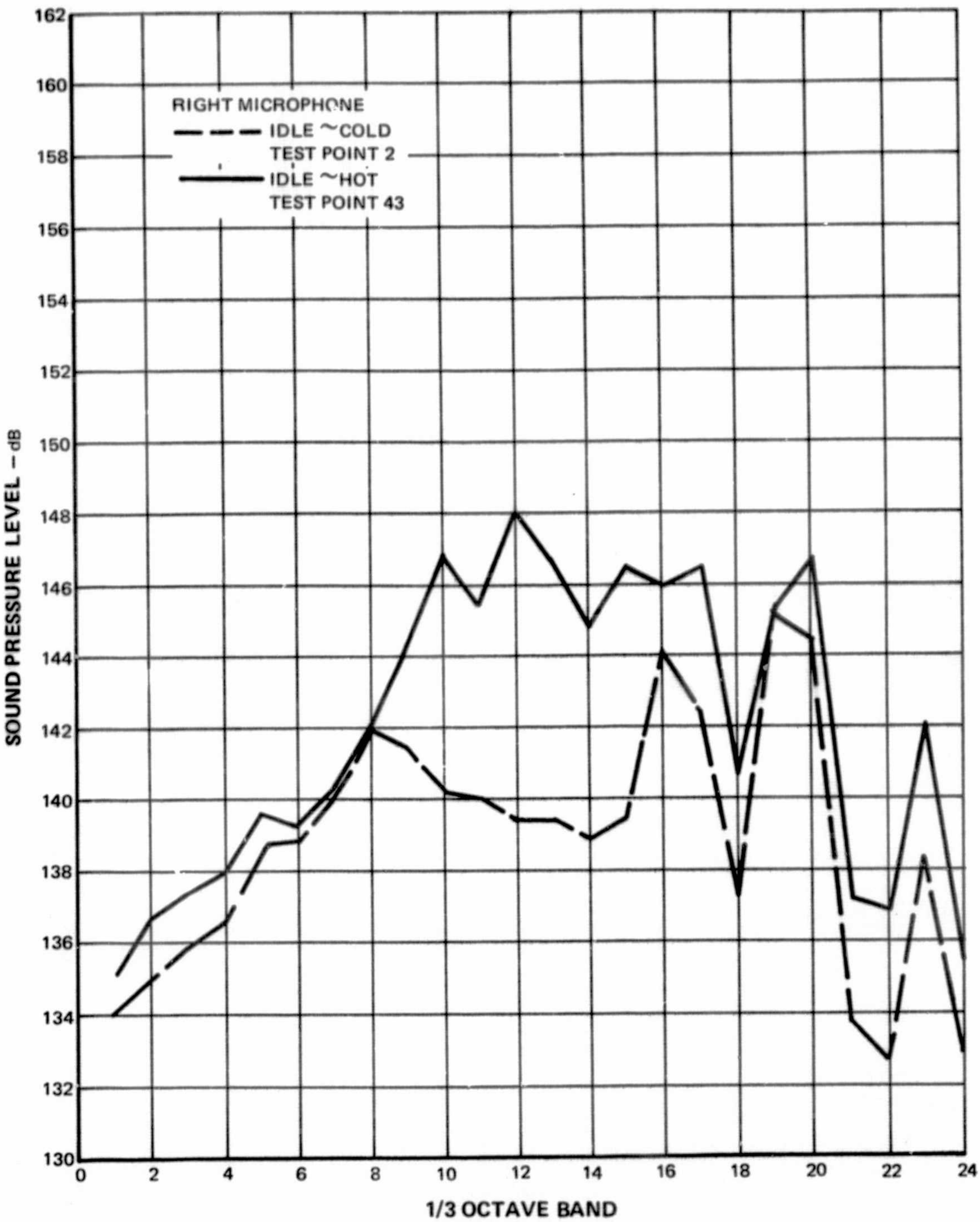


Figure 27a Third Octave Band Spectra for Configuration P-7 – Idle

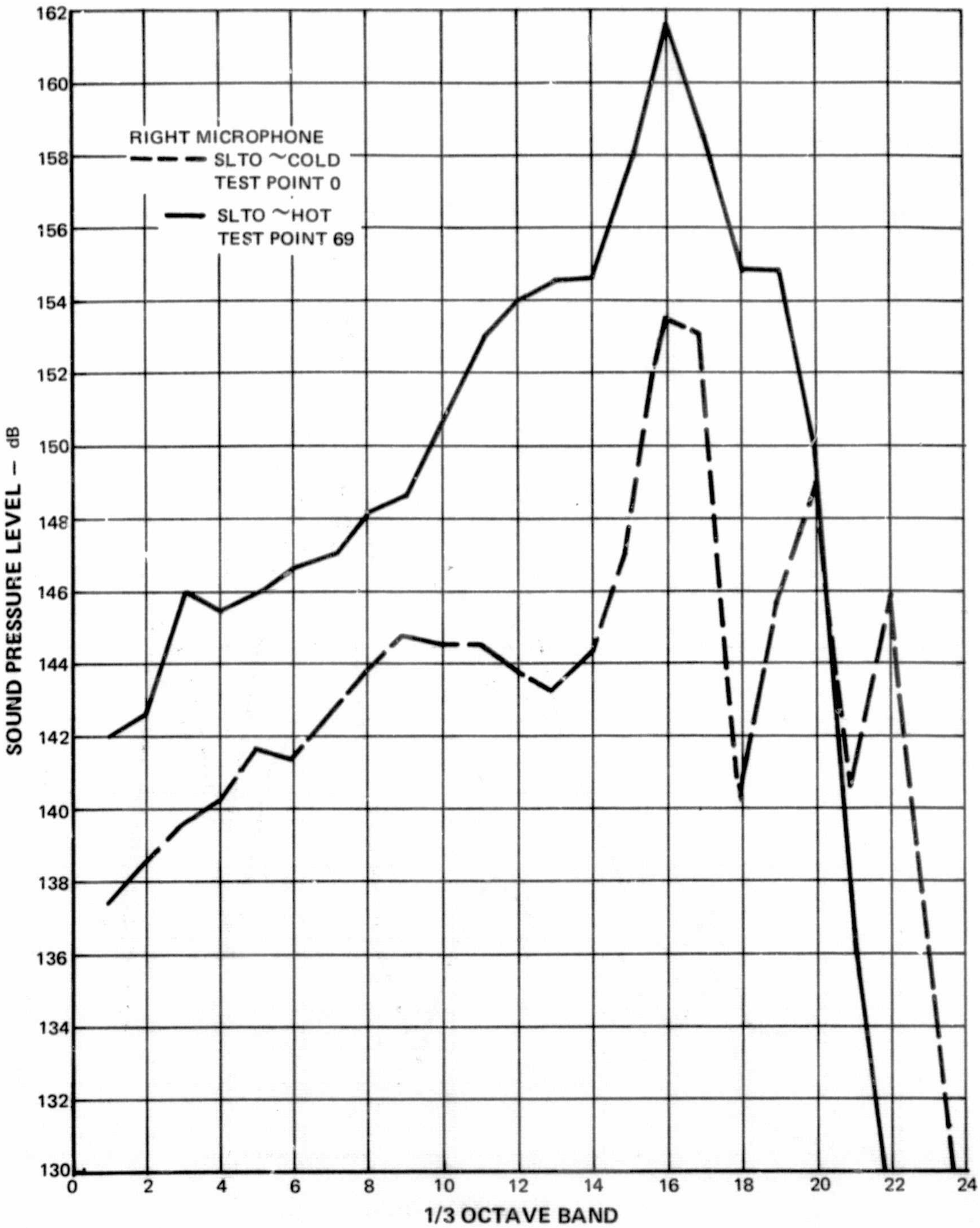


Figure 27b Third Octave Band Spectra for Configuration P-7 – SLTO

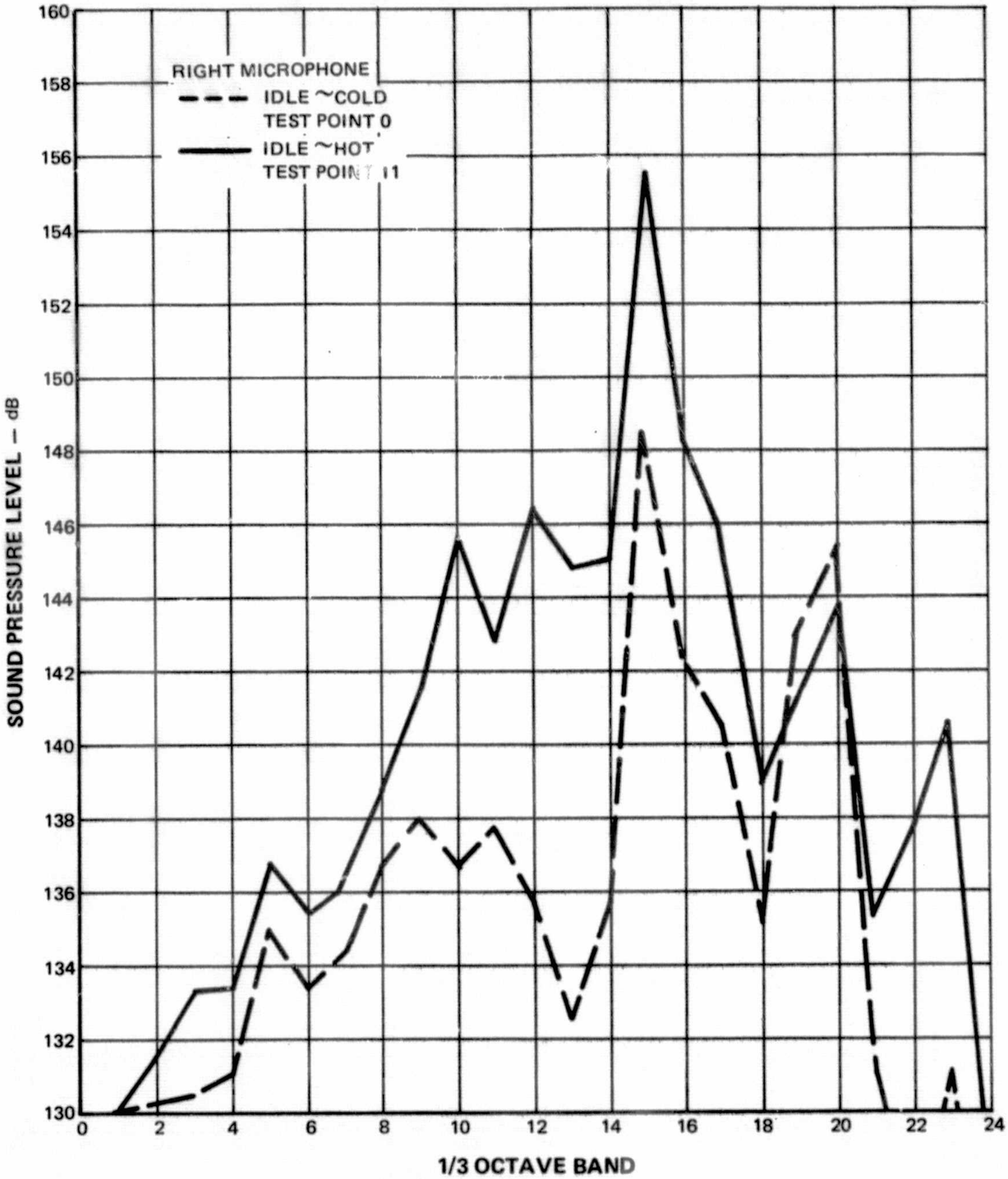


Figure 28a Third Octave Band Spectra for Configuration P-8-Idle

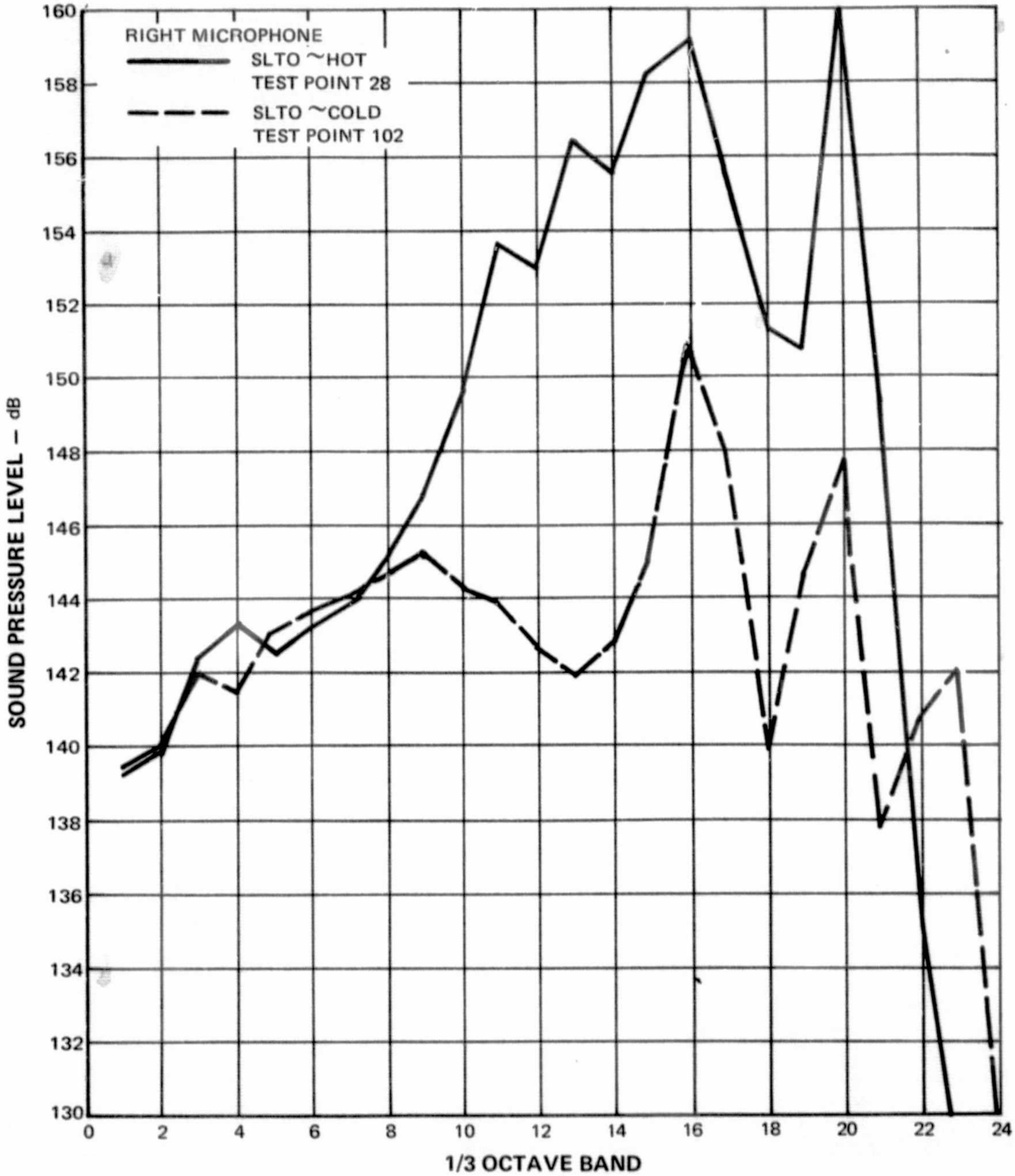


Figure 28b Third Octave Band Spectra for Configuration P-8-SLTO

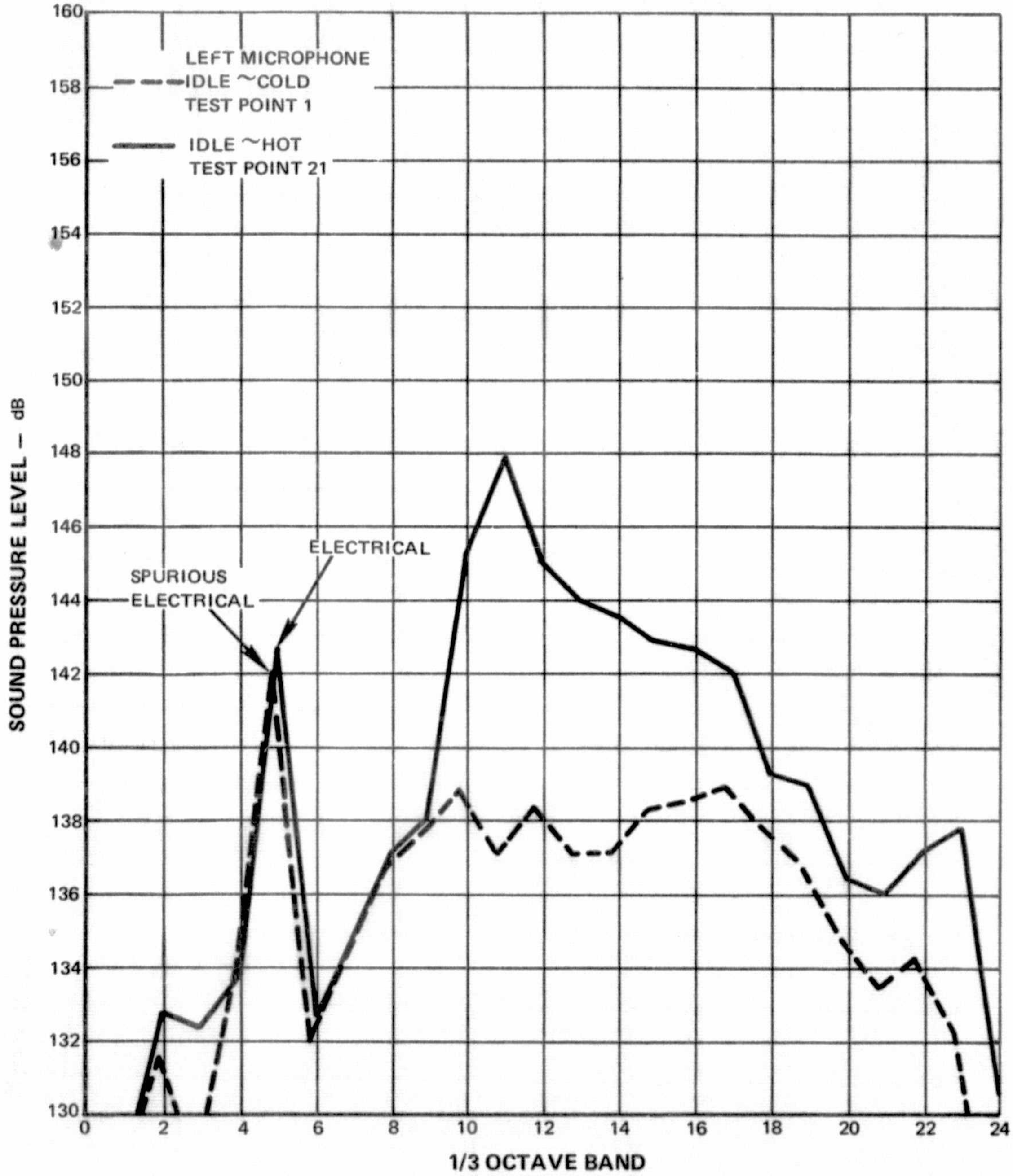


Figure 29a Third Octave Band Spectra for Configuration S-8 – Idle

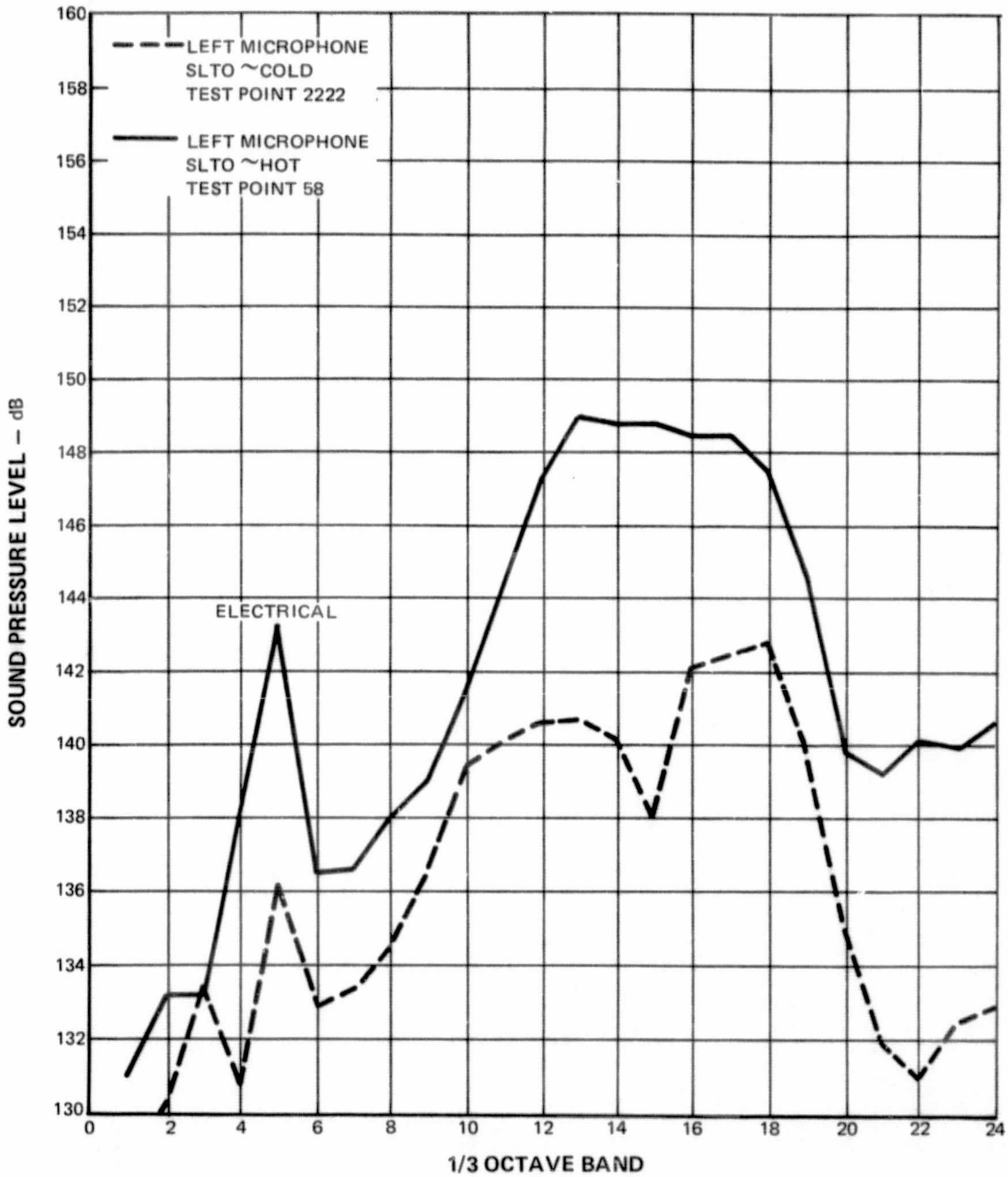


Figure 29b Third Octave Band Spectra for Configuration S-8 – SLTO

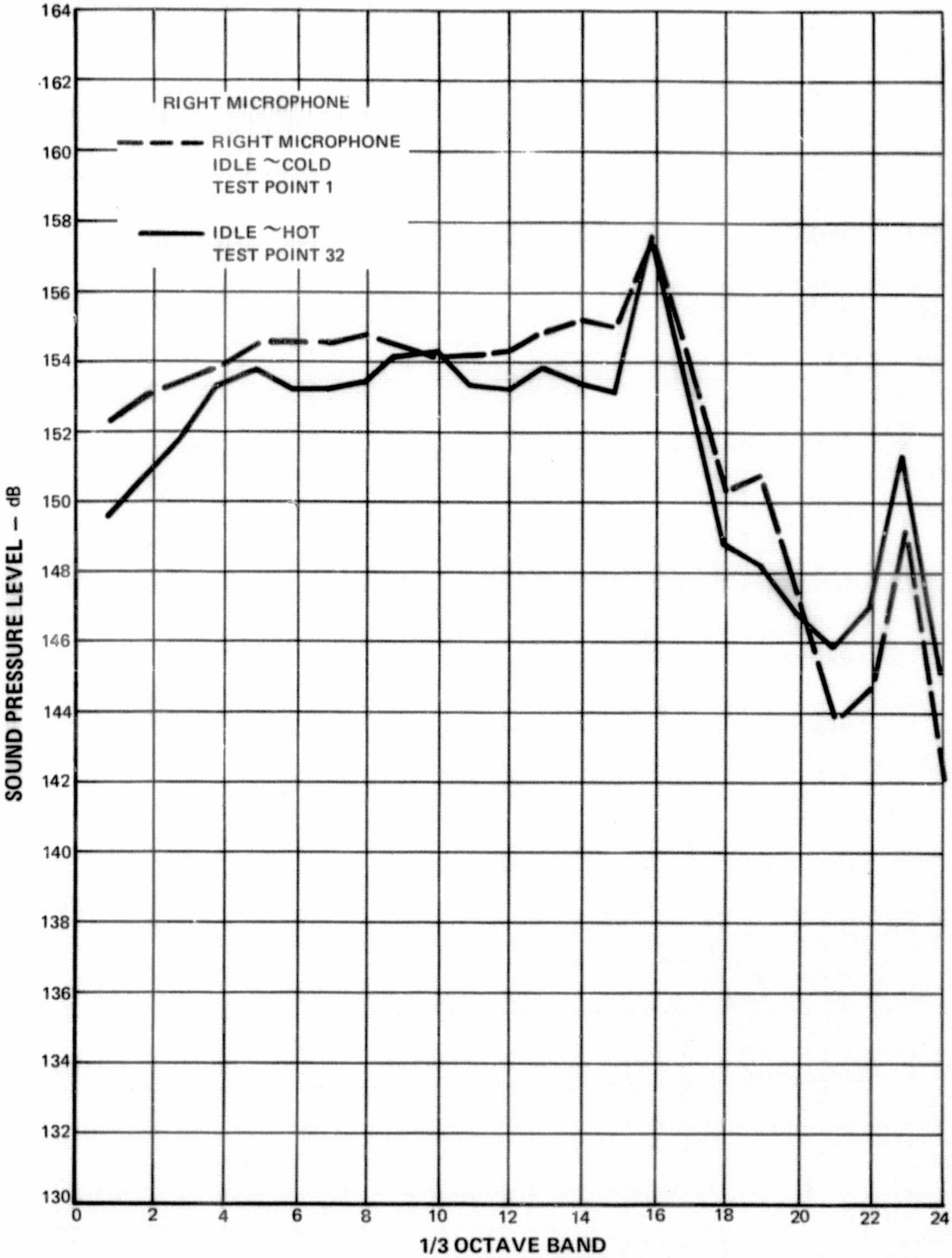


Figure 30a Third Octave Band Spectra for Configuration S-9 – Idle

Figure 30b Third Octave Band Spectra for Configuration S-9 – SLTO

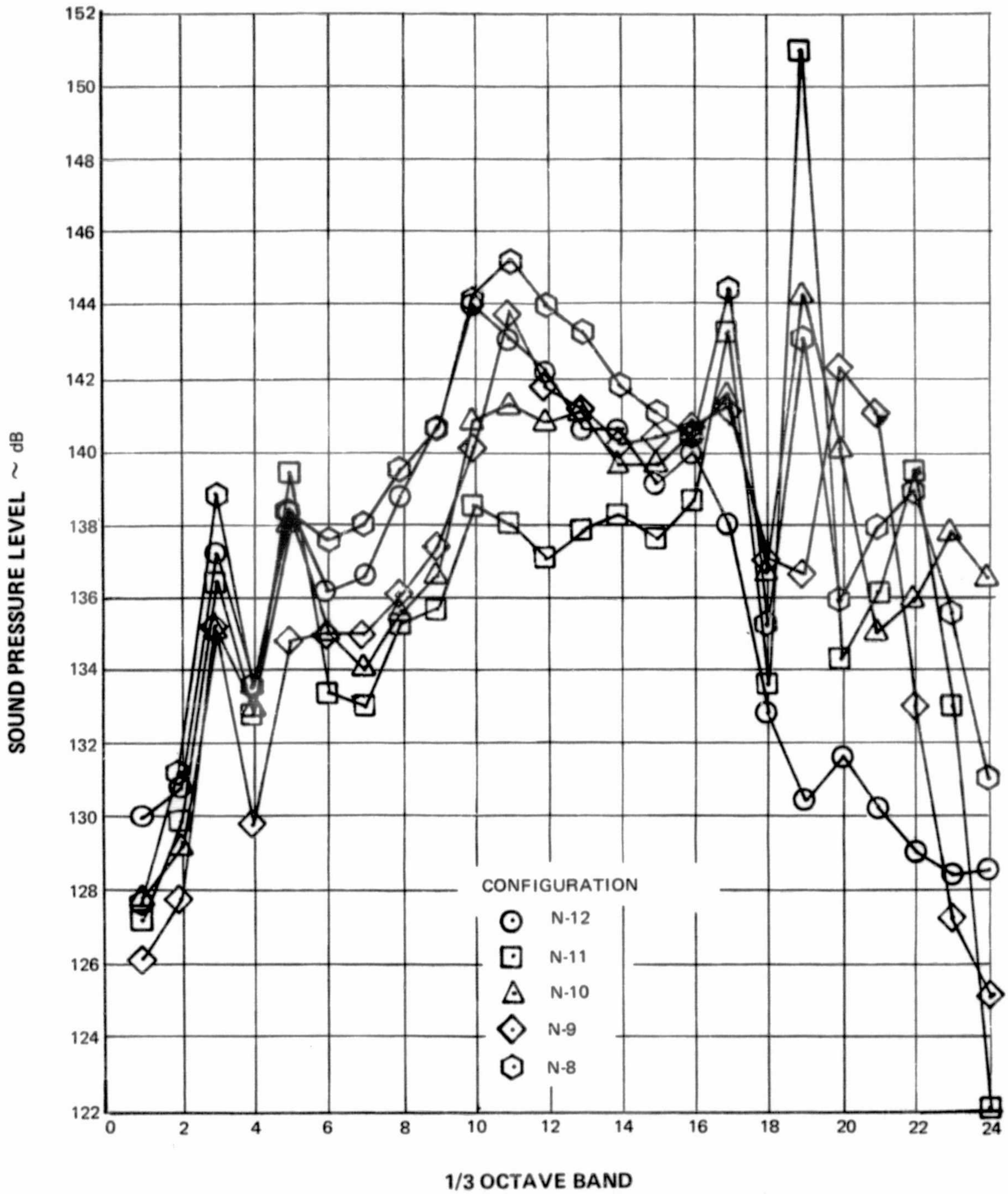


Figure 31 Comparison of Swirl Can Combustor Configurations – SLTO, Hot

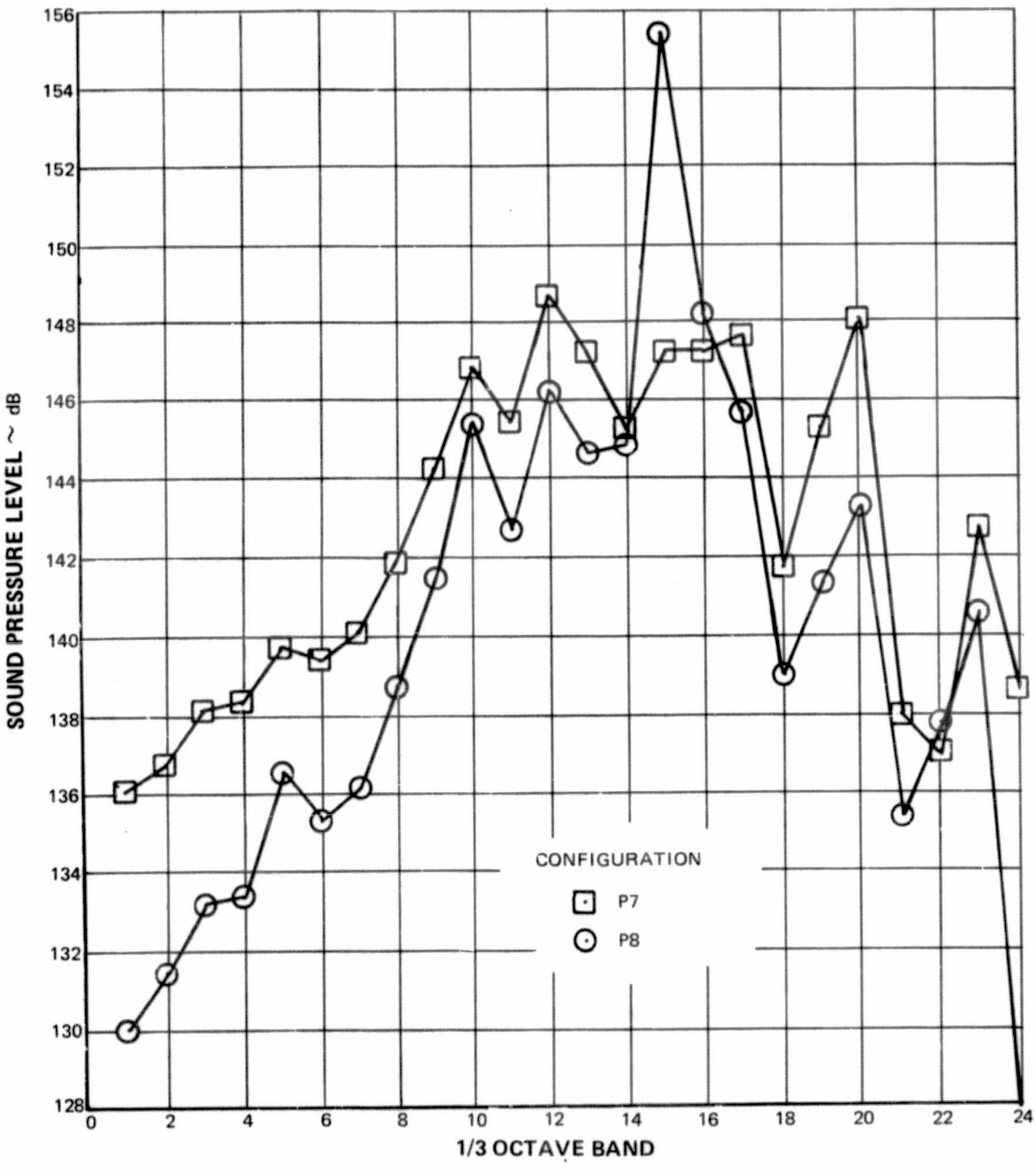


Figure 32 Comparison of Staged Premix Combustor-Configurations-Idle, Hot

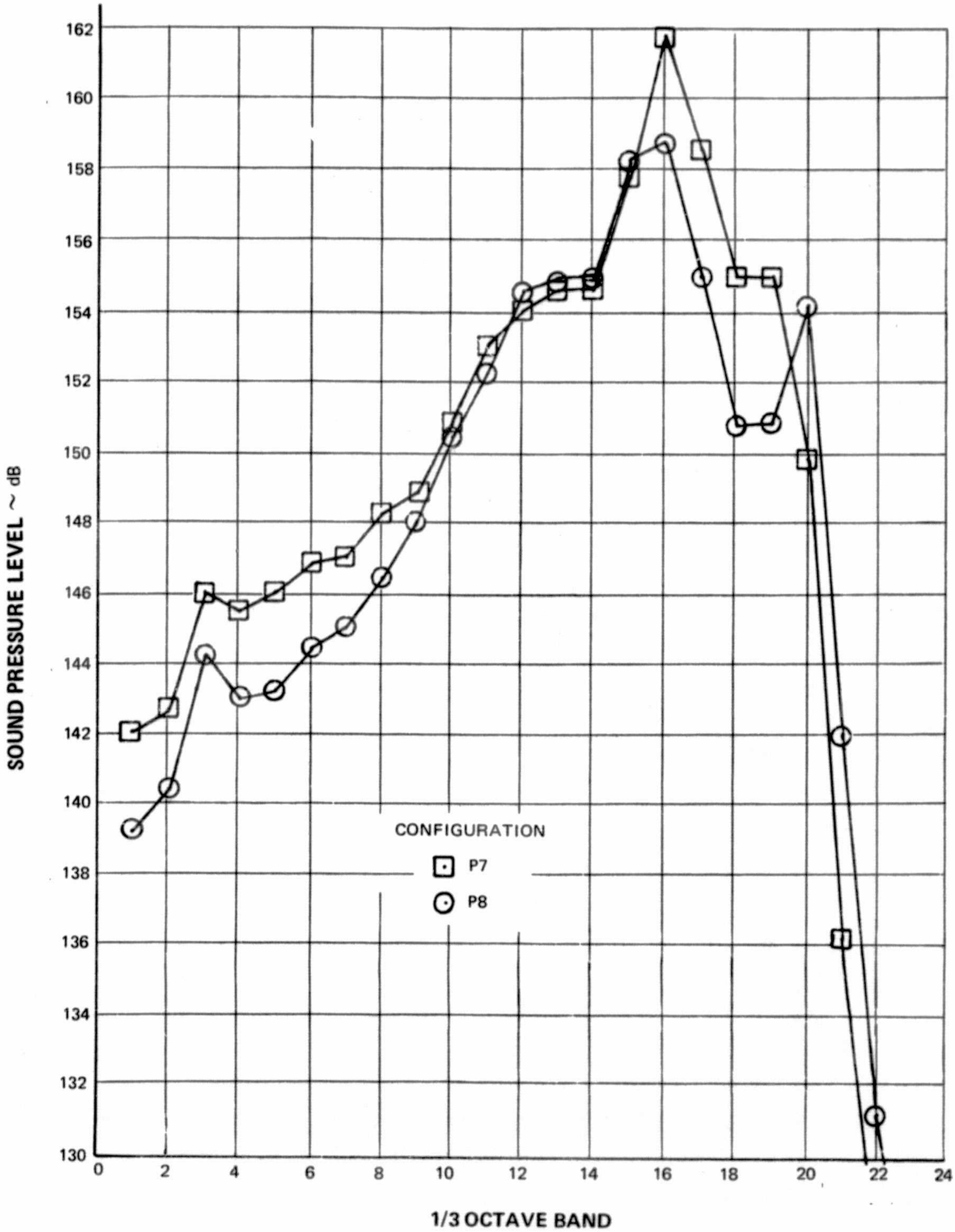


Figure 33 Comparison of Staged Premix Combustor Configurations-SLTO, Hot

APPENDIX A

RIG PERFORMANCE DATA

List of Symbols

SUBSCRIPTS

4	station upstream of burner
5	station downstream of burner
t	total condition
s	static condition
i	ideal
b	burner
pri	primary zone
sec	secondary zone

SYMBOLS		UNITS
P	pressure	ATM
T	temperature	°K
Wa	mass flow rate of air	kg/sec
Wf	mass flow rate of fuel	kg/sec
f/a	fuel-air ratio	
$\bar{M}$ ①	mass flow parameter	$\frac{kg\sqrt{K^\circ}}{sec - m^2 - ATM}$

NOTES:

① $\bar{M} = \dfrac{W_{a4}\sqrt{T_{t4}}}{A_4 P_{t4}}$, where A_4 is defined as 0.02002 m^2 for a 90° sector JT9D burner.

ECCP RIG PERFORMANCE (Sheet 1)

Config.	Point No.	Condition	W_{a4} (kg/sec)	W_{ab}[1] (kg/sec)	W_f pri (kg/sec)	W_f sec (kg/sec)	f/a[2] Carbon Balance	P_{s4} (ATM)	P_{t4} (ATM)	T_{t4} (°K)	P_{t5}[3] (ATM)	T_{t5i}[4] (°K)	$\overline{M}$ $\frac{kg - {}^{\circ}K^{1/2}}{sec\text{-}m^2 - ATM}$	$\frac{P_{t4} - P_{t5}}{P_{t4}}$ (%)	$T_{t5i} - T_{t4}$ (°K)
N-7	3	Idle-Cold	10.69	8.42	–	–	–	3.70	3.86	448	–	–	2927	–	–
	43	Idle	8.35	6.13	.0637	–	.0142	3.44	3.79	463	3.21	828	2368	15.4	363
	21	Idle	8.35	6.16	.0494	–	.0109	3.42	3.74	461	3.16	561	2394	15.6	100
	32	Idle	8.45	6.16	.0783	–	.0173	3.45	3.78	463	3.18	1350	2403	15.8	887
N-8	1*	Idle-Cold	7.64	5.93	–	–	–	2.74	3.10	433	2.70	–	2562	12.9	–
	21	Idle	7.64	5.92	.0502	–	.0120	3.51	3.77	455	3.42	738	2159	9.2	283
	32	Idle	7.67	6.03	.0405	–	.0090	3.50	3.77	460	3.42	622	2180	9.4	162
	43	Idle	7.73	5.91	.0671	–	.0143	3.46	3.74	460	3.38	896	2214	9.6	436
	810	SLTO	8.76	6.93	.0357	.0527	.0145	6.55	6.86	766	6.44	1266	1765	6.1	500
	79	SLTO	8.80	6.93	.0498	.0677	.0191	6.61	6.93	768	6.51	1416	1758	6.1	648
	68	SLTO	8.74	6.89	.0601	.0856	.0249	6.55	6.86	767	6.43	1592	1773	6.2	825
	0*	SLTO Cold	8.63	6.90	–	–	–	6.46	6.80	769	6.38	–	1758	6.1	–
N-9	1	Idle Cold	7.79	6.26	–	–	–	3.48	3.74	457	3.28	–	2224	12.2	–
	21	Idle	7.83	6.18	.0502	–	.0109	3.46	3.74	459	3.28	561	2240	12.3	102
	33	Idle	7.90	6.17	.0699	–	.0148	3.44	3.79	457	3.33	828	2226	12.2	374
	42	Idle	7.87	6.21	.0570	–	.0097	3.44	3.71	456	3.24	715	2263	12.6	259
	69	SLTO	8.77	6.99	.0499	.0687	.0220	6.40	6.73	770	6.19	1505	1806	8.0	735
	710	SLTO	8.75	7.04	.0358	.0490	.0161	6.42	6.74	770	6.21	1311	1799	7.9	541
	58	SLTO	8.75	6.97	.0575	.0825	.0257	6.46	6.80	770	6.27	1614	1784	7.8	844
	88	AST	8.69	7.04	.0579	.0823	.0265	6.43	6.78	843	6.20	1699	1859	8.5	856
	99*	SLTO-Cold	8.63	6.90	–	–	–	6.46	6.80	771	6.28	–	1760	7.6	

*Estimated Conditions

NOTES:

1. Wab = Wa4 – measured turbine cooling air bleed – estimated rig sidewall cooling airflow
2. fuel-air ratio computed from a carbon balance on the measured exhaust gas species concentration
3. computed values
4. computed from carbon balance fuel-air ratio, corrected for unreacted species (CO, THC) present in exhaust gas.

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ECCP RIG PERFORMANCE (Sheet 2)

Config.	Point No.	Condition	W_{a4} (kg/sec)	W_{ab} [1] (kg/sec)	W_f pri (kg/sec)	W_f sec (kg/sec)	f/a [2] Carbon Balance	P_{s4} (ATM)	P_{t4} (ATM)	T_{t4} (°K)	P_{t5} [3] (ATM)	T_{t5i} [4] (°K)	$\overline{M}$ $\frac{kg\text{-}°K^{1/2}}{Sec\text{-}m^2\text{-}ATM}$	$\frac{P_{t4}-P_{t5}}{P_{t4}}$ (%)	$T_{t5i}-T_{t4}$ (°K)
N-10	1*	Idle-Cold	7.80	5.98	–	–	–	3.44	3.80	457	3.25	–	2192	14.4	–
	21	Idle	7.80	5.98	.0502	–	.0074	3.50	3.78	459	3.23	675	2208	14.6	216
	33	Idle	7.86	5.99	.0672	–	.0103	3.48	3.76	454	3.20	800	2225	14.9	346
	42	Idle	7.74	5.90	.0569	–	.0090	3.44	3.72	458	3.17	737	2224	14.8	279
	69	SLTO	8.66	6.88	.0499	.0709	.0186	6.51	6.82	775	6.18	1410	1766	9.4	635
	710	SLTO	8.70	6.98	.0356	.0507	.0125	6.48	6.80	772	6.16	1204	1776	9.4	432
	58	SLTO	8.73	6.94	.0605	.0787	.0216	6.48	6.80	773	6.15	1499	1783	9.6	726
	88	AST	8.68	6.90	.0606	.0831	.0220	6.53	6.75	847	6.04	1573	1869	10.5	726
	89*	SLTO-Cold	8.63	6.90	–	–	–	6.46	6.80	771	6.17	–	1760	9.3	–
N-11	1*	Idle-Cold	8.01	6.08	–	–	–	3.74	3.74	456	3.13	–	2285	16.3	–
	21	Idle	8.01	6.08	–	.0504	.0074	3.46	3.13	458	3.00	675	2359	17.4	217
	42	Idle	8.03	6.07	–	.0572	.0092	3.43	3.73	458	3.11	783	2301	16.6	325
	33	Idle	8.05	6.07	–	.0675	.0108	3.44	3.75	454	3.14	841	2285	16.4	387
	69	SLTO	7.93	6.28	.0451	.0639	.0195	5.80	6.11	766	5.49	1416	1794	10.1	650
	710	SLTO	7.88	6.29	.0321	.0443	.0134	5.85	6.14	765	5.53	1234	1773	9.9	469
	58	SLTO	7.95	6.32	.0543	.0750	.0232	5.87	6.16	769	5.54	1543	1788	10.0	774
	88	SLTO	6.22	4.91	.0422	.0584	.0228	4.54	4.77	767	4.28	1529	1804	10.2	762
	60*	SLTO-Cold	7.95	6.36	–	–	–	5.87	6.19	769	5.58	–	1779	9.9	–

*Estimated Conditions

NOTES:

1. Wab = Wa4 – measured turbine cooling air bleed – estimated rig sidewall cooling airflow.
2. fuel-air ratio computed from a carbon balance on the measured exhaust gas species concentration.
3. computed values.
4. computed from carbon balance fuel-air ratio, corrected for unreacted species (CO, THC) present in exhaust gas.

ECCP RIG PERFORMANCE (Sheet 3)

Config.	Point No.	Condition	W_{a4} (kg/sec)	W_{ab} [1] (kg/sec)	$W_f$pri (kg/sec)	W_f sec (kg/sec)	f/a [2] Carbon Balance	P_{s4} (ATM)	P_{t4} (ATM)	T_{t4} (°K)	P_{t5} [3] (ATM)	T_{t5i} [4] (°K)	$\overline{M}$ $\frac{(kg-°K)^{1/2}}{Sec-m^2-ATM}$	$\frac{P_{t4}-P_{t5}}{P_{t4}}$ (%)	$T_{t5i}-T_{t4}$ (°K)
N-12	1*	Idle-Cold	7.99	6.26	–	–	–	3.57	3.74	478	3.08	–	2333	13.6	–
	21	Idle	7.99	6.26	.0505	–	.0087	3.50	3.78	454	3.30	724	2250	12.7	270
	42	Idle	7.99	6.17	.0571	–	.0090	3.48	3.81	459	3.35	734	2244	12.1	275
	33	Idle	8.09	6.22	.0670	–	.0103	3.44	3.74	454	3.25	752	2302	13.2	298
	69	SLTO	8.73	6.85	.0500	.0727	.0192	6.48	6.83	766	5.97	1428	1767	7.8	662
	710	SLTO	8.70	6.98	.0358	.0494	.0132	6.42	6.76	765	5.91	1235	1778	7.9	470
	58	SLTO	8.75	6.96	.0598	.0826	.0224	6.51	6.84	769	6.00	1520	1772	7.8	751
	88	SLTO	8.76	6.92	.0608	.0184	.0220	6.37	6.73	768	5.85	1560	1802	8.1	792
	60*	SLTO-Cold	8.63	6.90	–	–	–	6.46	6.80	769	6.96	–	1758	7.7	–
P-7	2*	Idle-Cold	7.38	5.47	–	–	–	3.51	3.75	454	3.42	–	2095	8.9	–
	43	Idle	7.61	5.29	.0772	–	.0128	3.46	3.71	462	3.35	943	2202	9.8	485
	32	Idle	8.06	5.64	.0833	–	.0131	3.41	3.76	457	3.36	952	2289	10.7	495
	58	SLTO	8.74	6.60	.0634	.0967	.0312	6.53	6.84	766	6.40	1760	1766	6.4	994
	69	SLTO	8.78	6.48	.0547	.0818	.0257	6.68	6.99	767	6.55	1412	1738	6.3	645
	88	SLTO	8.75	6.62	.0468	.1091	.0300	6.59	6.84	767	6.40	1630	1770	6.4	863
	99*	SLTO-Cold	8.63	6.90	–	–	–	6.43	6.80	768	6.02	–	1757	6.3	–
P-8	0*	Idle-Cold	6.38	4.36	–	–	–	3.46	3.74	768	3.07	–	2361	11.3	–
	11	Idle	6.38	4.36	.0609	–	.0120	3.49	3.69	459	3.44	917	1850	6.9	458
	28	SLTO	7.87	6.59	.0615	.0963	.0312	6.51	6.83	773	6.47	1763	1600	5.2	990
	39	SLTO	8.74	6.65	.0675	.1076	.0348	6.49	6.81	775	6.37	1869	1784	6.4	1094
	410	SLTO	8.24	6.54	.0553	.0848	.0268	6.45	6.81	773	6.42	1382	1680	5.8	608
	88	AST	8.71	6.59	.0616	.0961	.0320	6.48	6.83	843	6.35	–	1849	7.0	–
	102	SLTO-Cold	8.67	6.94	–	–	–	6.38	6.78	770	5.97	–	1772	6.4	–

*Estimated conditions.

Notes:

1. Wab - Wa4 – measured turbine cooling air bleed – estimated rig sidewall airflow.
2. fuel-air ratio computed from a carbon balance on the measured exhaust gas species concentration.
3. computed values.
4. computed from carbon balance fuel-air ratio, corrected for unreacted species (CO, THC) present in exhaust gas.

ECCP RIG PERFORMANCE (Sheet 4)

Config.	Point No.	Condition	W_{a4} (kg/sec)	W_{ab}^{1} (kg/sec)	W_f pri (kg/sec)	W_f sec (kg/sec)	f/a^{2} Carbon Balance	P_{s4} (ATM)	P_{t4} (ATM)	T_{t4} (^oK)	P_{t5}^{3} (ATM)	T_{t5i}^{4} (^oK)	$\overline{M}$ $\frac{kg\text{-}{}^oK^{1/2}}{Sec\text{-}m^2\text{-}ATM}$	$\frac{P_{t4} - P_{t5}}{P_{t4}}$ (%)	$T_{t5i} - T_{t4}$ (^oK)
S-8	1	Idle-Cold	6.81	5.45	–	–	–	3.11	3.53	313	3.28	–	932	7.0	–
	21	Idle	6.99	5.29	.0527	–	.0120	3.52	3.73	450	3.46	907	1986	7.3	457
	32	Idle	7.14	5.49	.0422	–	.0094	3.57	3.88	4.72	3.59	831	1997	7.4	359
	43	Idle	7.20	5.42	.0607	–	.0127	3.57	3.80	456	3.51	897	2021	7.6	441
	58	SLTO	8.79	6.86	.0489	.0888	.0261	6.53	6.82	750	6.42	1621	1763	5.8	871
	69	SLTO	8.81	6.91	.0442	.0788	.0232	6.52	6.83	752	6.43	1529	1767	5.9	777
	810	SLTO	8.65	6.73	.0123	.1141	.0229	6.53	6.84	748	6.46	1481	1728	5.6	733
	128	AST	8.92	6.84	.0250	.1055	.0216	6.46	6.81	826	6.36	1544	1880	6.6	718
	2222	SLTO-Cold	8.75	7.00	–	–	–	6.54	6.93	773	6.53	–	1754	5.7	–
S-9	1*	Idle-Cold	7.62	5.80	–	–	–	3.53	3.77	–	3.54	–	–	–	–
	21	Idle	7.62	5.80	.0525	–	.0110	3.44	3.70	458	3.37	875	2202	9.0	417
	32	Idle	7.79	5.97	.0389	–	.0085	3.42	3.71	459	3.36	778	2247	9.4	319
	43	Idle	7.73	5.88	.0661	–	.0148	3.47	3.75	456	3.41	1005	2199	9.0	549
	69	SLTO	8.65	6.96	.0445	.0810	.0222	6.53	6.84	772	6.45	1501	1755	5.7	729
	1145	SLTO	8.70	6.84	.0567	.0682	.0221	6.51	6.82	772	6.43	1514	1770	5.7	742
	1030	SLTO	8.69	6.75	.0375	.0873	.0219	6.51	6.82	771	6.42	1507	1767	5.8	736
	710	SLTO	8.67	6.89	.0318	.0578	.0152	6.53	6.85	771	6.45	1299	1755	5.8	528
	58	SLTO	8.70	6.82	.0381	.0695	.0185	6.49	6.80	772	6.41	1403	1776	5.8	631
	128	AST	8.85	7.11	.0249	.1013	.0216	6.55	6.91	845	6.47	1559	1860	6.4	714
	712	SLTO-Cold	8.71	6.97	–	–	–	6.41	6.79	772	6.39	–	1780	5.9	1008

*Estimated Conditions

NOTES:

1. Wab = Wa4 – measured turbine cooling air bleed – estimated rig sidewall cooling airflow.
2. fuel-air ratio computed from a carbon balance on the measured exhaust gas species concentration
3. computed values
4. computed from carbon balance fuel-air ratio, corrected for unreacted species (CO, THC) present in exhaust gas.

APPENDIX B

NOISE TRANSDUCER CALIBRATIONS

NOISE TRANSDUCER FREQUENCY RESPONSE CORRECTIONS APPLIED TO ONE-THIRD OCTAVE SPL DATA

1/3 Octave Center Frequency Hz	Transducer Serial Number							
	51690	51680	47642	51678	44248	44250	51686	51696
50	0.7	0.5	0.5	0	0.3	0	0.6	0.4
63	0.5	0.5	0.5	0	0.5	0	0.6	0.4
80	0.6	0.5	0.5	0	0.5	0	0.6	0.4
100	0.9	0.5	0.5	0	0.5	0	0.6	0.5
125	0.8	0.5	0.5	0	0.5	0	0.6	0.5
160	0.8	0.5	0.5	0	0.5	0	0.6	0.5
200	0.7	0.5	0.5	0	0.5	0	0.6	0.5
250	0.7	0.5	0.5	0	0.5	0.2	0.6	0.5
315	0.7	0.4	0.5	0	0.5	0.3	0.5	0.5
400	0.6	0.4	0.5	0	0.2	0.3	0.5	0.4
500	0.5	0.4	0.5	0	0.2	0.3	0.5	0.4
630	0.5	0	0.3	0	0	0	0.5	0.5
800	0	0	0.3	0	0	0	0.5	0
1000	0	0	0	0	0	0	0	0
1250	−0.6	0	0	0	0	−0.8	0	0
1600	−2.3	0	0	−0.4	0	−1.0	0	0
2000	−2.5	0	0	−1.5	0	−1.0	0	−0.5
2500	−1.2	−0.5	−3.0	−1.5	−1.5	−0.8	−3.0	−0.5
3150	−0.8	−1.5	−3.0	−1.7	−4.0	−2.0	−2.5	−1.0
4000	−10.0	−5.0	−5.0	−5.5	−5.0	−5.0	−1.6	−6.8
5000	+5.0	−6.5	−6.0	−8.0	−7.0	−5.5	−6.4	−4.0

Combustor Scheme No.	Transducer Location During Testing							
	51690	51680	47642	51678	44248	44250	51686	51696
S-8	Inlet						Right	Left
S-9				Left	Right	Inlet		
P-7	Inlet			Left	Right			
P-8	Inlet			Left	Right			
N-7	Inlet	Left						Right
N-8	Inlet		Right				Left	
N-9			Right			Inlet	Left	
N-10			Right			Inlet	Left	
N-11			Right			Inlet	Left	
N-12			Left			Inlet	Right	

APPENDIX C

1/3 OCTAVE SPL TABULATIONS

SWIRL COMBUSTOR N-7 DIFF. SCREEN RECESS SWIRLERS

	POINT # = 3 COLD FLOW IDLE			POINT # = 43 IDLE HOT			POINT # = 21 IDLE HOT		
1/3 OCT FREQUENCY (HZ)	INLET	LEFT	*RIGHT	INLET	LEFT	*RIGHT	INLET	LEFT	*RIGHT
50	133.6	177.6	128.9	136.4	156.6	127.4	136.7	161.6	128.4
63	133.6	177.9	130.6	134.4	158.1	132.2	134.8	161.9	132.9
80	137.4	177.6	130.0	137.7	160.2	133.8	137.8	162.2	134.2
100	138.1	178.0	130.4	136.4	158.8	130.1	137.5	162.0	130.6
125	142.9	178.6	132.8	140.5	158.9	133.7	139.9	162.7	133.5
160	144.3	178.9	132.6	141.5	159.1	132.3	140.6	162.7	132.3
200	147.0	179.2	133.2	143.7	159.4	133.1	142.9	163.3	132.5
250	151.5	178.7	136.4	146.0	160.0	136.0	146.4	163.6	135.7
315	150.5	177.9	136.9	146.3	159.8	140.2	146.5	163.8	138.3
400	146.0	178.1	137.9	145.7	159.2	142.2	145.8	163.5	139.9
500	147.9	178.3	137.6	144.4	158.6	143.1	142.9	162.7	140.3
630	151.6	176.2	138.8	147.7	158.5	140.5	147.9	162.6	138.5
800	148.4	177.0	149.6	146.5	158.1	147.0	146.9	162.2	146.4
1000	151.7	176.3	165.6	144.6	157.7	162.4	144.3	162.0	161.3
1250	152.1	173.5	160.5	145.5	157.2	156.1	143.9	161.7	156.0
1600	150.9	174.9	165.6	142.1	155.4	157.1	142.5	159.4	157.3
2000	153.9	174.5	177.2	144.2	155.6	172.5	144.9	160.0	172.7
2500	156.9	170.8	162.7	147.2	156.1	155.3	147.9	159.7	155.4
3150	161.0	165.6	160.2	151.5	150.8	151.9	151.8	154.6	151.9
4000	155.5	156.3	151.7	147.8	143.4	142.5	147.6	147.4	141.6
5000	160.3	154.3	152.7	152.0	144.2	142.2	151.8	146.7	141.3
6300	150.6	148.7	148.5	141.4	139.6	141.7	141.2	143.5	140.7
8000	127.6	134.7	130.3	117.7	125.0	126.5	117.4	127.6	126.0
10000	135.1	140.2	137.1	125.7	126.2	135.3	125.5	129.6	134.8
OASPL	166.7	190.0	178.1	159.2	171.0	173.2	159.3	174.9	173.3

	POINT # = 32 IDLE HOT		
1/3 OCT FREQUENCY (HZ)	INLET	LEFT	*RIGHT
50	135.9	162.3	127.0
63	133.4	164.0	128.7
80	136.4	165.3	133.0
100	136.3	164.0	129.5
125	139.3	164.3	132.8
160	140.2	164.6	131.3
200	142.6	164.9	132.9
250	146.8	165.6	136.6
315	147.5	165.5	141.1
400	146.9	164.5	144.0
500	145.1	163.9	144.9
630	148.3	163.8	142.3
800	147.2	163.3	148.4
1000	144.9	162.9	163.6
1250	144.3	162.4	156.7
1600	143.1	160.7	157.5
2000	145.2	160.8	173.6
2500	148.2	161.1	155.5
3150	152.3	155.6	152.0
4000	147.6	147.6	141.7
5000	151.9	147.1	141.0
6300	141.3	143.2	140.9
8000	117.5	128.8	126.8
10000	125.8	131.0	135.3
OASPL	159.7	176.4	174.3

1/3 OCTAVE SPL LEVELS CORRECTED 50–5000 Hz ONLY

SWIRL COMBUSTOR N-8 PERF. V-GUTTER DIFF. FIX

1/3 OCT FREQUENCY (HZ)	POINT # = 1 COLD FLOW IDLE INLET	LEFT SIDE	RIGHT SIDE	POINT # = 21 IDLE HOT INLET	LEFT SIDE	RIGHT SIDE	POINT # = 32 IDLE HOT INLET	LEFT SIDE	RIGHT SIDE
50	132.7	120.2	119.7	135.6	128.3	127.8	135.9	132.1	131.2
63	132.0	123.2	124.9	136.7	134.0	134.0	138.4	138.2	137.9
80	136.4	122.5	122.0	138.4	136.1	136.3	139.1	137.9	138.2
100	136.4	124.4	125.1	137.6	132.1	131.9	138.9	134.8	133.8
125	138.7	131.5	133.7	139.7	136.4	137.0	140.5	137.2	137.4
160	139.3	127.5	127.3	140.7	134.8	135.1	140.9	134.8	135.5
200	142.1	129.5	129.5	143.3	135.7	135.9	143.4	136.7	135.9
250	144.4	131.2	131.4	147.6	140.7	140.0	147.4	140.6	139.2
315	142.1	131.3	131.4	146.2	143.6	143.0	147.4	142.2	141.7
400	137.7	131.3	131.5	148.8	142.8	143.3	149.1	142.7	143.9
500	137.4	129.7	130.3	147.0	141.7	142.1	146.8	140.5	141.3
630	141.0	130.7	131.4	148.6	139.0	140.0	148.7	137.9	139.0
800	140.8	129.1	130.7	146.9	138.4	139.1	149.1	137.6	138.8
1000	148.6	126.7	130.0	150.6	136.0	138.9	150.7	137.0	138.6
1250	149.1	129.1	132.2	154.5	136.9	139.3	154.5	136.5	139.0
1600	140.5	127.0	132.7	146.4	136.1	139.2	146.4	134.8	139.0
2000	140.3	129.4	132.3	145.2	137.4	137.5	145.3	136.4	137.3
2500	144.4	123.6	132.0	145.7	127.4	132.1	145.5	127.2	131.6
3150	146.7	133.2	137.4	148.2	137.0	138.6	148.2	137.2	138.7
4000	131.1	126.4	132.2	136.4	130.2	134.7	136.9	130.1	134.5
5000	136.2	130.2	129.0	141.2	132.5	131.4	141.3	132.4	131.2
6300	138.3	129.6	126.9	141.7	131.7	127.4	141.9	131.7	127.3
8000	132.3	125.4	128.1	135.3	127.8	129.0	135.5	127.7	129.0
10000	128.3	123.2	126.2	130.9	123.9	128.5	131.3	124.0	128.6
OASPL	155.9	142.7	144.7	160.3	151.3	151.8	160.3	151.1	151.7

1/3 OCT FREQUENCY (HZ)	POINT # = 43 IDLE HOT INLET	LEFT SIDE	RIGHT SIDE	POINT # = 810 SLTO HOT INLET	LEFT SIDE	RIGHT SIDE	POINT # = 79 SLTO HOT INLET	LEFT SIDE	RIGHT SIDE
50	136.4	127.5	127.5	144.1	128.8	128.3	144.1	127.7	128.0
63	137.3	132.2	132.7	144.3	131.5	131.8	143.7	131.2	131.1
80	139.7	136.1	136.7	145.2	141.0	141.4	144.4	138.9	139.5
100	138.6	131.5	131.7	146.4	138.5	139.4	145.6	133.6	133.8
125	140.9	136.6	137.4	146.7	138.2	136.0	146.2	138.5	138.3
160	142.1	135.7	136.4	148.0	139.5	139.8	147.4	137.6	138.1
200	144.8	137.5	137.9	148.5	139.1	138.8	147.9	138.1	138.2
250	148.4	141.4	141.6	150.2	140.9	140.5	150.1	139.5	139.2
315	149.4	145.5	144.9	152.2	141.4	141.4	152.4	140.7	140.6
400	149.8	144.7	144.6	153.7	144.5	143.9	154.9	144.2	143.7
500	148.6	143.6	143.8	155.9	145.6	144.5	154.6	145.3	144.1
630	150.0	141.2	142.3	152.4	144.1	143.9	151.1	144.0	143.6
800	150.1	139.8	140.4	152.4	143.6	144.0	152.4	143.2	143.9
1000	151.3	139.5	140.3	154.0	142.0	143.0	153.5	141.9	143.0
1250	154.9	138.2	140.1	158.4	141.1	145.6	157.8	141.1	146.1
1600	147.2	137.4	139.9	149.2	140.3	145.6	149.2	140.5	145.2
2000	146.0	138.7	138.0	145.4	143.6	144.1	145.7	144.4	144.2
2500	146.0	128.5	133.5	149.8	135.0	137.9	149.7	135.2	138.1
3150	146.7	136.0	140.1	150.7	144.5	137.8	150.9	143.0	138.2
4000	137.8	130.8	135.3	139.9	138.7	136.1	139.7	135.9	136.5
5000	142.1	133.4	132.0	143.8	138.7	135.5	144.0	137.9	135.5
6300	142.5	132.0	128.3	143.1	138.2	134.8	143.1	138.9	135.0
8000	136.0	128.2	129.9	136.6	134.9	132.1	136.8	135.5	132.5
10000	131.7	124.6	129.1	135.1	130.2	134.5	135.4	131.1	134.9
OASPL	161.2	152.7	153.2	164.6	154.8	155.1	164.3	154.3	154.8

1/3 OCT FREQUENCY (HZ)	POINT # = 68 SLTO HOT INLET	LEFT SIDE	RIGHT SIDE	POINT # = 0 SLTO COLD INLET	LEFT SIDE	RIGHT SIDE
50	143.4	127.0	127.2	144.9	129.1	128.4
63	143.7	129.5	129.8	145.2	129.9	130.4
80	144.6	137.1	137.7	145.7	130.1	130.2
100	145.5	136.7	137.1	147.5	129.8	128.9
125	146.1	136.8	136.3	148.3	135.4	134.1
160	147.0	137.1	137.9	150.1	132.8	132.8
200	147.9	137.1	137.2	151.1	134.2	133.9
250	149.6	137.8	137.6	153.5	137.4	136.9
315	152.5	139.1	139.2	155.5	139.9	139.4
400	154.9	143.2	143.1	154.7	140.8	139.8
500	154.4	145.4	143.6	153.6	140.2	138.3
630	151.7	143.6	144.3	156.0	139.6	138.0
800	152.7	143.9	145.0	157.3	139.6	141.1
1000	153.4	142.8	143.8	160.9	140.5	140.1
1250	158.3	141.6	146.8	161.3	143.3	140.9
1600	149.7	141.3	145.9	153.9	140.9	142.2
2000	146.1	145.0	144.9	151.6	141.2	141.2
2500	150.1	136.1	139.2	155.1	135.2	143.6
3150	150.9	143.5	138.8	156.1	148.4	151.2
4000	139.8	136.3	136.8	151.5	143.6	140.6
5000	144.2	138.4	135.7	152.1	141.2	135.2
6300	143.4	139.7	135.5	151.2	135.3	133.0
8000	137.1	136.0	133.0	144.4	133.6	135.8
10000	135.7	131.9	135.6	141.7	130.5	139.1
OASPL	164.5	154.4	155.0	168.2	153.8	154.7

1/3 OCTAVE SPL LEVEL CORRECTED 50-5000 Hz ONLY

ORIGINAL PAGE IS OF POOR QUALITY

SWIRL COMBUSTOR N-9 OUTER SWIRLER FRONT END

1/3 OCT FREQUENCY (HZ)	POINT # = 1 IDLE COLD FLOW			POINT # = 21 IDLE HOT			POINT # = 33 IDLE HOT		
	INLET	LEFT SIDE	RIGHT SIDE	INLET	LEFT SIDE	RIGHT SIDE	INLET	LEFT SIDE	RIGHT SIDE
50	155.0	121.0	120.3	156.9	124.1	124.6	156.5	125.0	125.3
63	156.7	122.3	123.7	158.0	128.5	129.2	157.6	127.5	128.1
80	157.9	122.2	122.2	159.1	130.7	130.6	156.8	131.9	132.0
100	156.8	123.4	124.8	160.3	127.9	128.5	160.0	128.1	128.9
125	160.6	129.8	133.6	161.3	132.4	134.7	160.9	132.4	134.7
160	162.3	124.6	125.9	161.6	130.2	130.3	162.0	131.5	131.1
200	163.3	126.9	128.3	161.8	131.9	131.3	161.9	132.8	132.[illegible]
250	163.0	130.7	132.1	161.7	135.5	134.8	162.1	137.6	136.7
315	162.3	132.5	133.6	161.8	138.0	137.3	162.4	140.6	139.8
400	162.5	134.5	134.8	162.5	140.3	140.1	163.0	142.0	142.2
500	162.1	135.8	133.6	162.8	140.4	137.7	163.1	141.5	140.7
630	159.1	136.0	134.2	161.2	140.2	135.7	161.3	139.7	138.4
800	155.4	137.6	134.5	158.2	140.0	135.9	158.2	140.0	138.4
1000	153.6	136.5	132.5	156.0	136.1	134.9	156.0	139.2	137.6
1250	154.7	136.3	132.5	156.7	134.4	135.2	156.8	138.4	137.3
1600	148.5	138.6	133.9	150.5	138.4	139.1	150.9	141.7	143.3
2000	146.8	136.2	132.8	146.3	135.3	134.0	146.5	136.7	136.0
2500	150.3	129.3	131.8	153.7	127.8	132.1	153.7	133.0	132.4
3150	149.7	127.6	138.8	148.5	125.6	140.0	152.8	133.5	134.6
4000	143.6	126.1	134.4	141.9	122.9	134.3	161.4	136.6	134.3
5000	138.6	115.6	127.6	137.8	119.3	129.5	137.7	134.4	134.2
6300	124.1	112.4	125.1	123.8	115.2	127.2	123.7	132.6	125.9
8000	133.9	120.1	125.9	134.3	119.6	125.9	134.2	124.4	121.3
10000	124.6	120.0	124.0	125.2	121.4	120.8	125.1	122.2	119.[illegible]
OASPL	172.1	146.5	146.0	172.4	148.9	148.7	172.5	151.0	150.[illegible]

1/3 OCT FREQUENCY (HZ)	POINT # = 42 IDLE HOT			POINT # = 58 SLTO HOT			POINT # = 69 SLTO HOT		
	INLET	LEFT SIDE	RIGHT SIDE	INLET	LEFT SIDE	RIGHT SIDE	INLET	LEFT SIDE	RIGHT SIDE
50	156.4	124.6	125.0	143.8	127.6	128.7	143.2	126.2	127.8
63	157.5	127.0	126.4	144.4	128.4	129.1	143.9	127.9	129.0
60	158.7	131.1	130.8	145.1	135.7	135.8	145.0	135.3	135.1
100	160.0	127.5	128.1	145.4	130.9	131.5	146.4	129.8	130.7
125	160.8	132.2	134.4	146.4	134.0	134.6	147.4	134.8	135.7
160	161.8	130.1	130.3	146.8	134.2	134.1	147.8	135.0	134.6
200	162.1	131.9	132.4	147.7	134.8	134.8	147.8	135.0	135.0
250	162.4	136.0	135.8	149.0	135.8	136.5	148.8	136.2	137.0
315	162.9	138.7	138.7	150.6	137.1	138.1	150.3	137.5	138.5
400	163.3	139.9	140.6	152.4	141.6	143.1	151.7	140.2	142.0
500	163.6	139.3	139.2	154.0	144.7	145.5	151.8	143.8	143.1
630	162.0	138.2	137.5	155.1	143.2	146.1	151.0	141.8	143.4
800	159.0	139.1	138.2	154.8	143.0	147.[illegible]	151.0	141.3	143.6
1000	157.0	138.0	137.5	154.5	141.2	148.5	152.2	140.3	142.3
1250	157.6	137.2	138.0	156.0	140.8	154.3	156.0	140.4	145.4
1600	152.0	140.2	141.9	150.9	141.0	151.2	150.6	140.7	146.0
2000	147.7	137.4	136.7	146.6	141.3	142.7	148.3	141.2	145.4
2500	154.0	131.7	138.1	150.8	136.4	135.0	150.1	137.0	141.3
3150	149.8	132.0	139.6	149.2	135.0	135.[illegible]	150.9	136.6	144.9
4000	142.1	134.2	133.7	146.2	136.5	134.0	147.6	142.2	143.9
5000	138.4	129.5	121.3	144.2	133.6	119.6	144.3	141.0	131.7
6300	124.8	129.1	120.2	129.2	133.6	116.8	127.8	133.0	122.6
8000	134.6	129.2	121.2	135.7	136.2	111.2	132.6	127.2	113.6
10000	125.4	123.7	118.7	121.4	135.1	111.9	117.5	125.1	113.8
OASPL	172.8	149.4	150.2	164.3	152.6	150.8	163.2	152.4	154.8

1/3 OCT FREQUENCY (HZ)	POINT # = 710 SLTO HOT			POINT # = 88 AST HOT			POINT # = 99 SLTO COLD		
	INLET	LEFT SIDE	RIGHT SIDE	INLET	LEFT SIDE	RIGHT SIDE	INLET	LEFT SIDE	RIGHT SIDE
50	142.7	125.5	126.8	141.8	127.1	127.7	151.5	124.5	125.3
63	143.2	128.0	129.0	142.2	128.4	128.0	152.1	125.8	126.0
60	144.5	134.3	135.1	143.0	135.2	135.2	152.9	132.0	131.3
100	145.6	129.2	130.6	144.1	131.5	131.9	153.7	127.2	127.4
125	146.5	136.6	137.2	145.4	134.1	134.5	154.6	132.9	133.3
160	147.0	135.6	136.1	146.6	134.5	134.4	155.2	131.7	131.9
200	147.3	136.1	136.8	146.8	134.9	135.5	155.8	132.9	133.2
250	146.2	136.7	138.6	148.1	135.5	136.3	156.6	134.3	134.8
315	149.6	137.5	136.8	149.4	135.5	137.0	157.2	135.6	136.4
400	151.2	140.1	142.4	150.8	140.5	141.2	157.4	136.8	137.8
500	151.3	142.3	143.1	150.7	144.0	143.9	157.6	136.0	138.3
630	150.5	139.5	142.4	150.3	142.7	145.5	157.8	137.4	138.2
800	150.5	139.1	141.8	151.0	141.9	146.3	159.3	138.8	139.7
1000	151.4	139.1	140.9	152.4	141.3	146.1	162.6	138.2	138.9
1250	154.7	139.3	143.8	154.7	141.6	151.5	166.2	136.6	142.7
1600	149.7	139.7	143.1	150.0	143.0	155.1	157.5	137.4	143.8
2000	147.9	140.2	143.6	147.2	143.5	147.8	153.6	135.4	146.0
2500	149.2	136.8	140.7	147.8	140.5	137.1	156.7	130.9	138.5
3150	150.1	137.3	145.0	147.7	142.4	134.4	152.8	131.4	135.3
4000	147.4	139.9	142.2	146.2	142.1	131.9	147.5	136.2	134.6
5000	144.0	130.7	133.3	144.6	130.7	119.4	145.7	135.3	118.2
6300	128.0	124.3	123.8	130.1	125.4	118.1	130.0	127.1	115.5
8000	132.7	126.8	113.9	134.6	126.1	111.5	135.6	124.3	111.3
10000	117.6	125.8	112.9	120.2	126.4	114.2	125.5	121.4	111.6
OASPL	162.4	151.2	153.9	162.1	153.2	158.5	171.1	148.5	152.3

1/3 OCTAVE SPL LEVEL CORRECTED 50-5000 Hz ONLY

SWIRL COMBUSTOR N-10 DIFF. SCREEN, REDUCED DILUTION AIR

1/3 OCT FREQUENCY (HZ)	POINT # = 1 IDLE COLD FLOW			POINT # = 21 IDLE HOT			POINT # = 33 IDLE HOT		
	INLET	LEFT SIDE	RIGHT SIDE	INLET	LEFT SIDE	RIGHT SIDE	INLET	LEFT SIDE	RIGHT SIDE
50	151.3	120.9	117.7	153.5	127.3	126.1	148.6	126.9	126.6
63	151.2	123.7	120.0	153.7	129.5	128.4	148.3	128.5	128.0
80	152.2	121.0	119.7	154.3	133.8	133.7	149.2	134.5	134.9
100	154.5	124.9	120.3	155.2	129.7	128.1	149.6	130.7	130.4
125	155.4	134.2	124.8	156.4	136.1	131.3	151.7	135.8	131.8
160	160.8	124.7	128.8	159.2	130.6	130.2	152.7	132.0	132.6
200	159.6	127.1	126.4	164.4	131.7	132.1	156.7	134.0	135.2
250	160.4	131.5	130.3	162.7	135.0	134.9	154.2	137.4	138.0
315	161.3	132.5	132.7	161.0	138.8	139.0	151.5	141.1	141.8
400	158.0	133.6	133.9	158.9	140.2	140.6	150.0	142.3	142.7
500	152.3	137.6	133.2	152.6	140.3	141.4	150.1	142.5	143.1
630	148.2	134.6	134.6	146.9	139.0	139.6	144.9	140.6	141.6
800	145.5	135.3	135.4	144.3	137.7	138.6	143.3	139.0	140.0
1000	145.2	131.8	132.2	143.3	137.0	138.1	142.9	138.4	139.3
1250	147.4	131.5	132.4	146.2	136.1	137.5	146.4	136.6	138.0
1600	142.0	132.3	134.2	141.1	136.6	138.3	141.4	137.4	138.7
2000	140.3	131.9	132.0	139.7	134.9	135.2	139.5	135.5	136.1
2500	140.3	128.5	130.2	140.7	130.2	130.8	140.6	130.8	131.2
3150	141.4	142.1	133.7	141.5	139.9	134.2	142.0	140.3	134.0
4000	138.1	137.5	131.0	139.4	137.0	134.9	139.4	137.2	134.6
5000	138.7	133.1	127.6	139.3	131.6	131.1	138.9	132.2	131.5
6300	126.4	126.5	126.5	125.8	128.3	128.4	125.6	129.1	128.8
8000	134.7	130.6	129.4	135.1	131.5	129.9	135.5	132.0	130.7
10000	125.2	124.9	128.6	125.4	124.7	128.6	125.9	125.4	129.5
OASPL	168.6	147.0	144.8	169.7	149.7	149.7	162.8	151.1	151.3

1/3 OCT FREQUENCY (HZ)	POINT # = 42 IDLE HOT			POINT # = 69 SLTO HOT			CONDITION # : 710 SLTO HOT		
	INLET	LEFT SIDE	RIGHT SIDE	INLET	LEFT SIDE	RIGHT SIDE	INLET	LEFT SIDE	RIGHT SIDE
50	143.4	126.8	126.1	130.4	127.9	125.2	130.1	128.3	[illegible]
63	143.2	129.1	128.2	129.0	129.3	126.9	128.3	130.0	128.2
80	144.5	133.9	134.4	128.3	135.2	135.6	128.4	137.0	137.2
100	147.2	130.3	129.1	130.6	133.1	132.4	130.9	133.1	131.9
125	152.4	136.1	131.6	131.4	138.1	131.5	132.0	139.5	135.2
160	152.5	131.5	131.6	133.5	135.1	134.1	133.1	136.6	136.0
200	154.8	133.2	133.6	134.9	134.2	134.2	134.9	134.7	134.6
250	148.7	135.8	136.0	137.3	135.8	134.6	137.5	136.3	135.6
315	149.4	139.7	139.8	141.8	136.7	136.7	141.8	138.1	133.6
400	148.7	141.1	141.4	142.8	140.9	140.6	142.9	141.8	141.2
500	150.5	141.1	142.3	140.4	141.3	140.8	140.5	141.2	140.7
630	145.1	139.2	140.2	137.1	140.9	141.0	136.9	140.6	141.3
800	143.4	138.1	139.2	140.9	141.2	141.7	140.8	140.2	141.4
1000	142.4	137.5	138.6	143.9	139.7	140.6	144.4	138.9	140.1
1250	146.4	136.1	137.4	154.3	139.7	140.8	154.5	138.9	140.4
1600	142.0	136.4	136.0	148.6	140.6	142.4	149.7	139.5	142.0
2000	139.3	134.6	135.2	142.0	141.6	143.1	143.0	140.1	141.7
2500	140.8	130.3	130.7	142.5	136.8	138.7	142.7	135.5	137.5
3150	141.6	139.8	133.2	145.4	144.3	136.8	144.9	145.1	136.3
4000	139.7	136.9	133.8	140.2	140.1	135.0	139.9	140.4	134.6
5000	138.6	131.4	131.1	139.5	135.1	135.9	139.2	135.1	136.0
6300	125.3	128.7	128.8	125.5	136.0	136.8	125.3	135.3	136.3
8000	135.5	131.8	130.6	135.1	127.8	134.6	135.4	137.6	133.3
10000	125.9	125.0	129.8	125.8	136.6	132.8	126.0	136.3	132.0
OASPL	161.2	150.1	150.2	157.3	152.6	152.1	157.6	152.7	152.0

1/3 OCT FREQUENCY (HZ)	POINT # = 58 SLTO HOT			POINT # = 88 AST HOT			POINT # = 89 SLTO COLD		
	INLET	LEFT SIDE	RIGHT SIDE	INLET	LEFT SIDE	RIGHT SIDE	INLET	LEFT SIDE	RIGHT SIDE
50	131.3	128.2	125.7	130.3	128.6	131.0	131.1	127.6	123.4
63	129.6	129.6	126.5	129.2	130.1	130.8	129.7	129.2	126.3
80	129.3	134.2	134.4	127.6	132.6	132.9	129.4	134.4	134.5
100	131.6	133.8	133.3	130.1	135.0	137.8	131.5	129.6	126.4
125	132.2	137.2	130.9	131.0	138.2	139.1	132.7	138.8	123.8
160	133.9	135.7	135.4	133.1	136.3	138.9	134.6	133.2	133.2
200	134.4	134.2	134.0	135.3	138.2	139.7	134.7	133.5	133.5
250	137.3	135.1	134.3	137.5	137.0	137.5	137.9	135.1	133.7
315	141.9	136.6	136.6	141.7	136.5	136.3	141.9	136.0	136.1
400	142.9	140.6	140.3	143.8	140.9	141.7	142.0	137.6	137.3
500	140.7	141.7	141.2	141.7	142.1	141.9	140.2	137.9	137.9
630	137.4	141.1	141.2	137.8	141.2	141.9	136.5	136.6	136.5
800	141.2	141.6	142.0	140.8	141.3	141.4	141.3	138.7	138.9
1000	144.5	140.4	141.2	145.3	140.3	140.8	142.6	136.5	137.7
1250	153.1	140.0	140.4	146.5	139.6	141.2	144.6	134.9	136.4
1600	147.1	141.2	143.3	146.4	140.8	144.2	141.8	135.0	137.2
2000	141.7	142.3	142.8	142.2	142.4	143.9	142.2	134.7	135.9
2500	144.1	137.3	139.2	138.4	138.2	140.2	138.8	130.4	131.4
3150	147.4	145.0	136.8	139.9	146.5	137.9	144.6	143.2	134.2
4000	140.5	140.7	134.8	138.6	142.6	135.6	142.3	138.3	131.5
5000	134.5	135.0	135.9	139.4	135.4	136.0	140.5	127.9	127.7
6300	125.5	136.0	136.9	125.0	137.4	138.3	126.2	124.4	125.0
8000	135.6	137.7	134.8	134.8	129.1	136.1	135.2	130.4	127.1
10000	126.1	136.8	132.7	126.8	138.9	134.0	126.0	129.4	127.7
OASPL	156.8	153.0	152.4	154.6	153.7	153.4	153.6	149.7	148.3

1/3 OCTAVE SPL LEVEL CORRECTED 50-5000 Hz ONLY

SWIRL COMBUSTOR N-11 DIFF. SCREEN FULL DILUTION AIR

1/3 OCT FREQUENCY (HZ)	POINT # = 1 IDLE COLD FLOW INLET	LEFT SIDE	RIGHT SIDE	POINT # = 21 IDLE HOT INLET	LEFT SIDE	RIGHT SIDE	POINT # = 42 IDLE HOT INLET	LEFT SIDE	RIGHT SIDE
50	134.4	121.9	120.6	134.2	126.6	127.1	133.9	126.6	127.7
63	135.1	126.2	122.5	134.4	129.1	129.2	134.3	129.0	128.9
80	135.4	122.4	121.9	135.9	133.1	134.3	135.4	133.6	134.7
100	136.5	126.5	121.9	136.5	129.2	129.2	136.3	129.7	129.8
125	137.6	135.8	125.4	138.0	136.0	131.9	137.9	135.6	132.1
160	136.4	125.7	125.2	138.8	130.5	131.1	138.9	131.2	131.8
200	139.3	128.2	127.8	140.0	131.7	132.5	139.9	132.3	133.0
250	141.6	132.1	130.7	141.2	134.4	134.5	141.1	135.0	135.1
315	142.3	132.4	133.0	141.6	137.0	138.2	141.2	137.6	139.2
400	141.8	133.7	133.5	141.8	128.8	139.6	141.6	139.8	140.4
500	141.9	131.7	132.1	141.9	135.1	140.6	141.6	140.0	141.7
630	143.5	137.8	133.7	143.8	136.7	138.5	143.5	137.8	139.4
800	143.0	136.8	134.2	145.5	136.1	137.7	145.3	136.8	138.3
1000	144.6	137.4	132.9	[illegible]	136.5	137.3	148.2	137.4	138.1
1250	151.6	135.4	134.4	[illegible]	135.2	136.3	149.0	135.9	137.0
1600	149.6	136.5	134.2	145.9	135.6	137.3	146.2	136.5	137.8
2000	143.1	137.8	132.1	140.9	137.3	134.6	140.9	137.8	134.9
2500	141.6	128.3	141.5	141.9	127.7	131.1	142.2	128.3	131.3
3150	141.8	145.4	138.4	142.4	145.1	136.0	142.6	145.4	138.0
4000	138.6	130.5	136.9	140.2	130.1	141.2	140.2	130.5	141.3
5000	138.6	132.8	129.0	138.8	132.3	133.0	138.6	132.8	133.0
6300	126.6	131.1	129.5	125.1	130.4	130.0	124.8	131.1	130.1
8000	134.1	130.7	136.3	135.3	130.2	130.4	135.3	130.7	130.5
10000	124.3	124.5	133.7	126.1	124.1	129.9	126.2	124.5	129.8
OASPL	156.6	149.3	147.6	156.1	149.9	149.9	156.1	150.5	150.4

1/3 OCT FREQUENCY (HZ)	POINT # = 33 IDLE HOT INLET	LEFT SIDE	RIGHT SIDE	POINT # = 69 SLTO HOT INLET	LEFT SIDE	RIGHT SIDE	POINT # = 710 SLTO HOT INLET	LEFT SIDE	RIGHT SIDE
50	133.9	126.9	128.0	128.8	125.3	125.9	129.0	125.8	125.7
63	134.1	130.6	130.7	127.5	126.1	127.1	128.0	129.0	128.0
80	135.4	133.2	134.3	127.7	135.6	136.6	128.0	136.5	137.6
100	136.4	129.8	129.3	128.9	131.3	131.0	129.0	131.3	130.7
125	137.6	136.1	132.2	130.8	137.6	132.1	131.2	138.5	133.9
160	138.6	131.9	137.1	133.3	134.1	134.6	132.7	133.8	134.5
200	140.0	133.0	137.2	133.5	133.1	133.1	133.6	133.0	133.1
250	141.0	136.2	137.8	134.9	134.0	132.9	134.9	134.9	134.4
315	141.4	135.6	141.3	136.4	133.3	134.1	136.8	134.9	135.6
400	141.7	140.7	141.2	137.5	136.5	136.8	137.2	136.8	136.6
500	141.8	141.2	142.7	135.8	136.5	136.9	135.7	136.3	136.9
630	143.5	138.9	140.5	133.1	136.0	137.5	133.0	135.4	137.0
800	145.2	137.6	139.0	132.8	136.2	137.9	132.3	135.0	136.6
1000	148.3	138.1	136.4	133.4	136.6	137.1	133.1	135.3	135.7
1250	149.1	136.5	137.7	132.7	136.5	137.4	131.8	135.4	136.4
1600	146.4	137.1	138.1	130.6	137.4	139.0	130.4	136.1	137.2
2000	141.1	138.4	135.6	131.0	141.8	139.7	130.8	140.1	137.8
2500	142.3	128.5	131.4	131.7	132.0	135.1	131.4	130.6	133.4
3150	142.7	145.7	137.9	137.5	146.2	134.2	136.8	145.9	133.3
4000	140.3	130.5	140.9	134.5	130.6	133.6	133.5	130.2	132.2
5000	138.6	133.1	133.2	133.6	134.2	134.1	132.6	134.0	133.7
6300	124.9	131.5	130.3	121.4	136.3	134.1	120.9	134.8	133.5
8000	135.3	130.9	131.1	132.4	134.2	132.2	132.4	133.3	131.0
10000	126.1	124.5	130.8	124.1	130.5	131.2	124.0	131.0	131.1
OASPL	156.1	151.2	151.3	147.0	150.9	149.2	146.7	150.5	148.6

1/3 OCT FREQUENCY (HZ)	POINT # = 58 SLTO HOT INLET	LEFT SIDE	RIGHT SIDE	POINT # = 88 SLTO HOT INLET	LEFT SIDE	RIGHT SIDE	POINT # = 89 SLTO HOT INLET	LEFT SIDE	RIGHT SIDE
50	128.9	127.3	127.0	127.1	123.4	125.0	128.9	123.3	124.3
63	127.3	130.0	127.4	125.4	126.8	125.7	127.6	126.8	124.6
80	127.7	136.5	136.1	126.4	130.2	135.5	125.5	130.3	131.1
100	128.6	132.9	132.9	126.9	128.1	129.8	128.4	128.1	126.5
125	130.6	139.6	131.5	128.4	137.5	129.8	131.5	137.5	128.9
160	133.5	133.5	135.0	130.8	130.8	131.5	133.8	130.7	134.6
200	133.5	133.1	133.0	132.3	132.0	130.5	133.6	132.0	133.4
250	134.9	135.4	132.7	134.9	135.1	131.8	136.6	135.0	134.5
315	136.4	135.6	133.8	139.6	132.0	134.6	137.6	131.9	132.7
400	137.2	136.6	136.4	140.5	137.5	136.4	137.0	133.8	133.3
500	136.2	136.2	137.5	137.4	133.8	136.3	134.9	133.9	134.1
630	133.4	137.2	137.7	134.0	131.2	136.5	131.7	131.2	131.7
800	132.7	137.9	138.7	137.8	131.7	137.4	132.4	131.6	133.1
1000	133.4	138.3	137.7	140.1	130.5	136.4	133.0	130.4	130.8
1250	132.0	137.7	137.8	139.3	128.8	136.4	131.2	128.8	129.9
1600	130.7	138.7	139.6	136.7	129.2	138.0	129.1	129.2	130.8
2000	131.3	143.4	140.2	136.6	132.9	138.8	129.3	132.8	130.6
2500	131.7	133.7	135.6	136.2	125.3	134.6	130.5	125.2	127.3
3150	137.1	151.0	134.2	139.8	145.3	135.6	137.3	145.2	133.2
4000	133.9	134.4	132.9	137.8	129.3	135.1	134.7	129.3	134.7
5000	132.9	136.2	134.1	137.5	136.4	132.5	132.6	136.4	128.4
6300	121.3	139.5	134.0	123.8	128.5	131.5	121.5	128.4	125.5
8000	132.7	133.1	132.3	132.8	127.7	130.6	132.4	127.8	127.9
10000	124.2	122.1	132.2	122.8	126.8	129.5	124.0	126.8	127.6
OASPL	146.9	153.8	149.5	149.9	148.4	148.4	146.9	148.3	145.2

1/3 OCTAVE SPL LEVEL CORRECTED 50-5000 Hz ONLY

SWIRL COMBUSTOR N-12 DIFF SCREEN PRESSURE ATOMIZING NOZZLES

1/3 OCT FREQUENCY (HZ)	POINT # = 1 COLD IDLE FLOW			POINT # = 21 IDLE HOT			POINT # = 42 IDLE HOT		
	INLET	LEFT SIDE	RIGHT SIDE	INLET	LEFT SIDE	RIGHT SIDE	INLET	LEFT SIDE	RIGHT SIDE
50	172.2	123.5	123.7	168.5	126.7	129.0	167.0	129.1	131.3
63	172.5	126.1	124.7	168.6	129.7	131.1	167.0	133.7	134.0
80	172.8	127.5	124.6	169.0	134.0	134.9	167.0	134.6	135.3
100	173.2	128.2	126.5	169.4	131.1	132.8	167.2	132.5	134.5
125	173.3	134.2	135.0	169.5	136.7	137.0	167.3	137.4	138.0
160	173.3	129.3	128.4	169.5	134.5	136.4	167.1	137.0	139.0
200	173.1	130.2	129.2	169.5	135.8	137.6	167.2	137.9	140.3
250	173.9	133.1	132.9	170.0	138.9	140.0	167.7	140.4	141.9
315	174.7	133.1	133.0	170.7	140.0	140.6	167.9	142.0	141.8
400	175.7	133.9	133.9	171.5	141.0	141.3	168.7	141.7	143.2
500	175.7	133.2	133.5	172.2	140.2	140.3	169.7	142.1	142.3
630	173.5	133.0	132.8	171.3	139.0	139.2	169.4	140.2	140.7
800	170.8	132.3	132.4	169.2	138.1	138.8	167.4	139.0	139.8
1000	167.6	131.7	132.1	167.1	136.6	136.5	165.8	137.7	137.9
1250	166.8	133.9	133.4	166.3	136.2	135.6	168.1	136.8	137.1
1600	161.1	134.1	135.2	160.1	136.3	136.2	159.8	136.3	137.0
2000	161.2	132.9	132.9	159.1	134.2	133.7	156.7	134.3	135.9
2500	166.9	131.5	133.4	163.8	129.7	131.3	161.8	130.2	133.9
3150	158.4	134.4	146.1	157.2	131.2	143.1	156.5	132.2	144.2
4000	153.2	144.4	142.6	151.7	137.2	139.4	150.8	138.4	143.9
5000	154.3	133.2	131.1	150.4	130.4	131.7	148.2	131.5	131.7
6300	137.7	130.2	129.3	134.6	128.9	131.2	135.4	130.1	119.7
8000	145.0	130.2	125.8	143.8	130.7	125.6	144.8	132.0	114.5
10000	134.5	124.8	123.6	134.2	126.4	120.2	135.2	128.2	121.5
OASPL	185.0	148.0	149.6	181.7	149.9	151.2	179.7	151.2	153.0

1/3 OCT FREQUENCY (HZ)	POINT # = 33 IDLE HOT			POINT # = 69 SLTO HOT			POINT # = 710 SLTO HOT		
	INLET	LEFT SIDE	RIGHT SIDE	INLET	LEFT SIDE	RIGHT SIDE	INLET	LEFT SIDE	RIGHT SIDE
50	164.7	129.4	131.3	160.7	130.1	130.4	160.2	128.5	129.9
63	164.9	133.4	133.9	161.2	130.9	131.6	161.1	130.9	130.7
80	164.6	135.7	136.3	162.6	137.3	137.1	162.1	136.5	136.4
100	164.6	132.9	134.7	163.3	133.7	134.4	163.2	132.7	133.4
125	164.8	138.1	138.5	163.9	138.4	136.5	164.0	138.5	136.5
160	164.9	137.7	139.3	164.5	136.3	137.1	164.5	135.1	136.3
200	164.8	139.6	141.5	165.3	136.6	137.4	164.8	135.6	136.4
250	165.3	141.0	142.5	166.3	138.8	138.3	166.0	138.2	138.1
315	165.7	142.0	142.2	167.1	140.7	140.6	166.8	140.4	140.0
400	166.5	142.5	144.1	167.9	144.1	143.3	167.6	143.0	142.2
500	167.6	142.4	142.8	168.8	143.2	143.7	168.8	142.7	142.1
630	167.9	140.6	140.9	170.3	142.3	143.9	170.2	141.3	142.0
800	166.3	139.2	140.0	170.9	140.7	142.0	170.7	140.4	141.7
1000	165.0	137.8	138.4	172.8	140.7	140.8	172.6	140.6	141.2
1250	167.3	136.6	137.9	174.2	139.2	140.0	173.9	138.7	140.2
1600	158.9	136.3	137.9	170.2	140.0	139.9	170.1	140.0	140.4
2000	155.8	134.4	137.2	165.1	138.1	140.7	164.7	138.3	141.9
2500	161.0	130.3	136.4	167.7	132.8	137.6	167.5	132.2	140.9
3150	155.8	132.0	144.9	161.2	130.5	147.5	160.3	130.5	147.8
4000	150.6	137.8	141.7	155.5	131.7	145.0	155.2	131.3	141.4
5000	147.9	131.5	127.6	153.2	130.3	130.5	153.1	130.4	127.0
6300	134.6	130.2	117.2	137.9	129.0	118.2	137.4	128.4	114.3
8000	144.7	132.1	113.3	144.7	128.4	115.4	144.5	128.2	114.9
10000	135.3	128.3	120.9	135.6	128.5	118.4	135.5	127.8	118.1
OASPL	177.8	151.6	153.4	181.1	152.2	154.3	180.9	151.6	153.8

1/3 OCT FREQUENCY (HZ)	POINT # = 58 SLTO HOT			POINT # = 88 AST HOT			POINT # = 60 SLTO COLD		
	INLET	LEFT SIDE	RIGHT SIDE	INLET	LEFT SIDE	RIGHT SIDE	INLET	LEFT SIDE	RIGHT SIDE
50	159.2	129.7	130.1	152.7	127.2	130.8	153.5	129.2	128.4
63	160.4	131.5	131.4	153.2	130.3	131.2	154.4	131.5	130.3
80	161.1	137.7	137.2	154.4	132.6	136.5	154.9	133.3	132.3
100	162.2	134.4	134.6	155.4	130.3	135.3	156.1	131.4	130.4
125	163.1	138.4	135.8	156.4	137.6	135.3	157.1	138.3	134.7
160	163.7	136.5	137.0	157.4	133.2	136.8	157.9	135.8	136.2
200	164.0	137.4	137.3	157.8	134.5	137.5	158.6	136.6	136.4
250	165.0	138.6	138.4	158.8	135.8	138.3	159.7	136.7	136.4
315	165.9	140.6	140.4	160.2	138.1	139.6	161.1	139.3	139.5
400	167.0	143.5	143.1	161.1	140.1	142.3	162.1	141.2	140.4
500	168.0	143.8	142.4	162.1	140.2	142.5	162.7	140.8	140.8
630	169.3	141.9	141.6	163.0	138.9	141.8	163.7	140.3	140.1
800	169.8	141.1	140.7	164.8	140.3	140.9	164.9	140.6	139.7
1000	172.0	140.8	140.7	168.3	139.1	141.2	167.8	138.6	138.3
1250	173.2	138.8	138.9	170.6	137.2	139.3	170.0	137.0	137.7
1600	169.0	140.3	138.3	168.1	138.2	138.7	168.0	138.6	137.5
2000	163.6	138.5	142.7	162.4	136.1	142.2	164.8	138.1	140.9
2500	166.5	132.7	133.1	164.1	130.8	133.6	164.5	131.3	132.5
3150	159.7	130.5	149.7	159.2	131.6	150.9	161.5	132.2	152.0
4000	154.1	131.7	134.4	153.9	130.2	135.0	155.1	131.2	137.2
5000	152.1	130.2	139.2	152.1	128.9	132.3	154.1	129.5	133.5
6300	136.8	128.9	134.4	137.5	126.0	131.7	138.9	126.4	130.1
8000	144.0	128.4	115.7	144.2	127.2	130.0	145.5	127.2	128.6
10000	134.8	128.4	117.2	135.3	126.8	125.7	136.1	126.9	128.3
OASPL	180.0	152.2	154.2	176.3	149.8	154.5	176.5	150.6	154.4

1/3 OCTAVE SPL LEVEL CORRECTED 50-5000 Hz ONLY

PREMIX COMBUSTOR P-7 SLOTTED FLAMEHOLDER

1/3 OCT FREQUENCY (HZ)	COLD FLOW IDLE POINT # = 2			POINT # = 43 HOT IDLE FLOW			POINT # = 32 IDLE HOT		
	INLET	LEFT SIDE	RIGHT SIDE	INLET	LEFT SIDE	RIGHT SIDE	INLET	LEFT SIDE	RIGHT SIDE
50	168.1	151.0	134.2	162.9	155.6	135.1	162.4	160.2	136.1
63	167.9	151.0	135.1	163.0	155.5	136.7	163.1	160.2	136.9
80	168.5	151.0	136.0	163.5	155.4	137.4	163.6	159.9	138.3
100	169.3	151.2	136.7	163.7	155.4	137.9	164.4	159.4	138.4
125	170.0	151.4	138.8	164.3	155.7	139.6	164.9	159.4	139.8
160	170.2	151.4	138.9	164.7	155.4	139.3	165.5	159.1	139.5
200	170.1	151.2	140.2	164.9	155.3	140.3	165.6	158.9	140.2
250	170.0	151.4	142.0	165.3	155.3	142.1	166.0	158.2	142.1
315	170.0	151.1	141.5	165.3	155.5	144.2	166.1	157.7	144.5
400	169.9	151.0	140.3	165.6	156.9	146.8	166.0	158.0	147.1
500	170.0	150.5	140.1	165.1	155.9	145.4	165.3	156.9	145.6
630	170.6	150.8	139.5	163.7	156.6	148.1	163.7	157.8	148.9
800	171.1	151.0	139.5	161.1	154.4	146.7	161.6	156.5	147.5
1000	171.1	151.6	139.0	160.1	152.8	144.9	161.0	156.3	145.6
1250	169.9	151.3	139.6	160.1	152.5	146.5	161.2	155.9	147.4
1600	164.7	151.0	144.2	154.7	155.2	146.0	154.9	158.0	147.4
2000	162.8	150.2	142.4	153.4	153.3	146.5	153.4	156.8	147.8
2500	160.4	146.7	137.4	151.1	146.6	140.7	151.7	150.9	141.0
3150	163.7	146.6	145.2	154.8	148.6	145.4	154.9	152.2	145.6
4000	149.8	144.2	144.6	141.6	145.8	146.7	142.5	149.9	148.2
5000	155.0	139.8	133.9	143.9	140.3	137.2	145.2	143.9	138.0
6300	152.0	135.5	132.8	146.6	138.7	136.9	147.6	140.8	137.0
8000	144.2	140.2	136.4	139.6	144.1	142.0	140.7	145.3	142.9
10000	140.9	138.2	132.7	138.3	142.1	138.4	139.0	142.3	138.7
OASPL	[illegible]	163.6	154.0	175.7	167.7	157.5	176.2	170.9	158.8

1/3 OCT FREQUENCY (HZ)	POINT # = 58 SLTO HOT			POINT # = 69 SLTO HOT			POINT # = [illegible] SLTO HOT		
	INLET	LEFT SIDE	RIGHT SIDE	INLET	LEFT SIDE	RIGHT SIDE	INLET	LEFT SIDE	RIGHT SIDE
50	177.7	169.6	141.4	180.4	166.5	142.1	180.8	165.1	140.0
63	177.6	170.1	142.2	180.6	166.9	142.7	181.2	166.2	141.2
80	178.0	170.3	144.1	181.7	167.9	146.0	181.6	166.6	142.3
100	178.5	170.4	144.3	182.5	167.9	145.5	182.5	166.5	143.4
125	176.7	170.6	144.0	182.3	167.9	146.0	182.7	166.6	143.9
160	178.1	169.7	145.1	180.8	167.6	146.8	182.2	165.8	144.9
200	177.1	169.2	146.0	179.3	167.1	147.1	180.8	165.0	145.5
250	176.0	168.9	147.1	178.2	166.5	148.3	180.0	164.8	146.5
315	175.0	168.2	148.2	177.3	166.1	148.8	179.1	164.3	147.7
400	175.2	167.9	151.6	176.4	165.7	150.9	178.1	164.4	150.3
500	175.1	167.7	155.4	175.5	165.6	153.1	176.6	164.2	151.6
630	174.5	166.7	154.0	175.2	165.1	154.1	176.5	164.1	154.5
800	172.7	165.4	155.8	172.3	164.3	154.6	173.4	163.4	153.4
1000	173.6	163.7	155.9	173.6	162.6	154.7	174.7	162.0	154.5
1250	169.7	162.2	158.9	171.0	161.4	157.8	171.8	159.9	156.1
1600	164.9	162.7	161.8	164.1	162.4	161.8	164.6	160.1	161.1
2000	162.0	163.2	159.2	160.9	162.2	158.7	161.7	161.7	157.0
2500	161.9	152.8	157.0	161.8	152.2	155.8	162.6	150.5	153.2
3150	159.4	151.8	156.1	164.8	151.2	155.0	166.0	151.8	154.8
4000	148.6	146.0	150.3	148.7	145.1	149.8	151.0	144.8	149.5
5000	153.6	141.4	136.6	153.6	140.2	136.3	154.1	140.3	136.4
6300	154.2	139.9	128.6	153.7	139.7	128.0	154.2	139.9	127.0
8000	146.0	144.1	125.3	145.7	144.8	125.0	146.0	147.4	124.1
10000	143.0	145.7	123.2	142.2	144.8	122.8	142.4	145.8	122.2
OASPL	180.2	160.5	167.8	190.9	178.3	167.1	193.6	170.9	166.1

1/3 OCT FREQUENCY (HZ)	POINT # = 0 SLTO COLD		
	INLET	LEFT SIDE	RIGHT SIDE
50	179.6	159.6	137.5
63	179.4	160.1	138.7
80	180.4	160.0	139.6
100	180.3	160.0	140.2
125	180.7	160.0	141.7
160	180.7	159.9	141.4
200	180.7	159.3	142.6
250	180.7	159.7	143.8
315	180.7	159.6	144.8
400	180.5	160.2	144.6
500	179.3	160.7	144.6
630	178.0	161.8	143.8
800	174.9	163.0	143.3
1000	175.7	162.0	144.3
1250	171.9	158.5	147.1
1600	165.8	157.1	153.6
2000	162.6	159.1	153.1
2500	165.1	147.6	140.4
3150	167.9	147.3	145.7
4000	151.8	142.5	148.7
5000	155.3	157.9	140.6
6300	154.8	135.6	145.5
8000	146.4	141.7	137.2
10000	142.7	146.0	126.9
OASPL	191.2	172.6	159.6

1/3 OCTAVE SPL LEVEL CORRECTED 50–5000 Hz ONLY

PREMIX COMBUSTOR P-8 SLOT, FLAMEHOLDER 2X INJECTORS

1/3 OCT FREQUENCY (HZ)	POINT # = 1 IDLE COLD FLOW INLET	LEFT SIDE	RIGHT SIDE	POINT # = 11 IDLE HOT INLET	LEFT SIDE	RIGHT SIDE	POINT # = 28 SLTO HOT INLET	LEFT SIDE	RIGHT SIDE
50	169.4	150.0	130.1	171.2	151.9	130.0	170.2	137.1	139.3
63	169.8	150.2	130.3	171.8	152.4	131.5	170.7	138.5	139.9
80	170.2	150.3	130.6	172.1	153.1	133.3	170.9	142.1	142.5
100	170.3	150.8	131.1	172.4	154.2	133.4	172.1	142.9	143.3
125	170.1	151.1	135.0	172.4	154.4	136.7	172.5	142.4	142.6
160	169.5	150.8	133.4	172.1	154.2	135.4	172.9	143.3	143.3
200	168.9	150.5	134.3	171.3	153.6	136.2	172.3	143.5	143.9
250	168.9	150.4	136.6	171.5	153.4	138.8	172.3	145.6	145.2
315	169.5	149.9	138.0	172.1	152.9	141.6	172.5	147.1	146.9
400	170.4	149.2	136.8	172.4	153.3	145.7	173.2	151.2	149.7
500	170.4	148.5	137.8	172.3	151.7	142.8	173.6	153.9	153.6
630	169.7	148.5	135.8	171.6	152.1	146.4	173.6	153.1	153.0
800	167.7	149.0	132.5	169.5	151.6	144.9	172.1	156.4	156.4
1000	165.6	150.2	135.6	167.6	151.7	145.1	170.8	151.6	155.5
1250	162.9	152.1	148.5	165.2	152.7	155.7	170.2	153.3	158.3
1600	157.7	153.6	142.3	160.3	153.1	148.5	164.8	154.7	159.2
2000	153.9	150.4	140.6	156.0	150.4	145.8	159.1	153.6	155.7
2500	152.9	148.6	135.3	155.0	148.5	139.1	159.2	151.9	151.4
3150	159.6	153.9	143.0	161.6	153.7	141.4	163.1	154.2	150.8
4000	146.6	150.3	145.2	147.5	149.4	143.5	148.4	147.1	160.2
5000	144.2	140.9	131.2	145.5	142.0	135.5	147.7	140.6	149.3
6300	141.0	133.7	126.2	144.9	136.9	137.8	147.6	139.2	135.3
8000	133.5	134.3	131.1	136.7	141.4	140.7	139.0	142.4	128.1
10000	131.6	131.8	124.0	135.6	136.5	128.0	137.6	146.4	124.7
OASPL	181.1	163.7	153.0	183.2	165.7	158.8	184.0	164.2	166.8

1/3 OCT FREQUENCY (HZ)	POINT # = 39 SLTO HOT INLET	LEFT SIDE	RIGHT SIDE	POINT # = 410 SLTO HOT INLET	LEFT SIDE	RIGHT SIDE	POINT # = 88 AST HOT INLET	LEFT SIDE	RIGHT SIDE
50	171.5	137.4	139.0	172.8	137.2	139.3	173.0	139.0	141.4
63	171.9	138.2	140.2	172.7	138.1	140.4	173.7	139.9	141.8
80	172.4	140.9	141.7	173.2	144.0	144.2	174.4	141.4	143.4
100	172.8	142.0	142.6	174.1	141.7	143.0	175.5	142.7	144.5
125	173.5	141.8	142.7	174.7	142.5	143.3	175.8	143.1	144.4
160	173.7	142.9	143.7	174.4	143.6	144.5	175.9	143.6	145.4
200	173.1	143.6	144.0	174.1	144.3	145.1	175.7	144.0	146.1
250	173.4	145.0	145.0	174.2	146.3	146.4	176.0	145.6	147.1
315	173.8	146.7	146.8	174.8	148.1	148.0	176.0	146.8	148.2
400	174.2	150.4	149.4	175.6	151.4	150.5	176.2	150.4	150.2
500	179.9	153.7	153.6	174.9	152.7	152.3	175.2	153.6	153.1
630	174.0	153.2	152.8	173.3	154.9	154.6	173.1	152.9	152.8
800	171.8	156.5	156.4	170.9	154.8	154.9	170.3	156.2	156.1
1000	170.0	151.9	155.7	168.8	150.8	155.0	168.2	152.7	155.9
1250	169.3	153.4	158.1	167.8	153.7	158.4	167.6	154.1	158.6
1600	163.9	154.9	159.5	162.5	154.6	158.8	162.1	156.1	161.3
2000	158.0	154.1	156.4	156.4	152.8	155.0	155.3	156.9	157.4
2500	158.5	152.6	153.2	157.2	150.3	150.8	157.1	154.1	151.7
3150	161.7	154.9	154.4	160.7	153.5	150.9	159.1	156.1	150.3
4000	146.2	148.0	155.6	145.4	147.3	154.2	143.7	149.2	152.5
5000	147.2	140.7	142.1	146.0	139.2	142.1	146.1	140.5	149.2
6300	146.3	139.8	132.1	144.9	138.7	131.3	144.5	140.7	151.0
8000	138.1	142.5	127.1	136.8	141.6	125.7	136.4	143.0	138.6
10000	136.1	146.6	124.3	134.6	145.3	123.1	134.5	147.5	129.9
OASPL	185.6	164.4	166.4	185.3	163.9	165.7	186.2	165.2	166.9

1/3 OCT FREQUENCY (HZ)	POINT # = 102 SLTO COLD INLET	LEFT SIDE	RIGHT SIDE
50	170.9	136.8	139.5
63	171.5	138.1	140.1
80	172.2	140.0	142.0
100	172.5	138.9	141.6
125	173.3	141.7	143.1
160	173.2	141.0	143.7
200	[illegible].0	141.3	144.1
250	173.3	142.8	144.7
315	173.9	144.1	145.3
400	174.5	143.7	144.3
500	174.3	142.5	143.9
630	173.9	141.6	142.7
800	172.3	141.5	141.9
1000	170.5	142.4	142.8
1250	168.9	142.6	145.2
1600	163.2	143.3	151.1
2000	157.8	142.7	147.8
2500	157.8	142.4	140.0
3150	161.8	154.2	144.6
4000	146.8	146.3	147.7
5000	147.7	141.4	137.8
6300	144.9	135.0	140.7
8000	136.8	140.8	142.0
10000	135.4	144.4	129.3
OASPL	184.6	158.1	158.0

1/3 OCTAVE SPL. LEVEL CORRECTED 50-5000 Hz ONLY

VORBIX COMBUSTOR S-8 UPSTREAM SWIRLER NO DILUTION AIR

1/3 OCT FREQUENCY (HZ)	POINT # = 1 COLD FLOW IDLE INLET	LEFT SIDE	RIGHT SIDE	POINT # = 21 IDLE HOT INLET	LEFT SIDE	RIGHT SIDE	POINT # = 32 IDLE HOT INLET	LEFT SIDE	RIGHT SIDE
50	126.9	128.3	125.5	130.3	128.4	123.9	130.5?	128.3	124.0
63	132.3	131.7	127.1	131.6	132.8	126.6	132.0	132.6	127.1
80	134.0	128.6	126.6	134.3	132.4	130.0	134.3	132.4	130.3
100	137.4	133.9	128.9	134.8	133.9	128.2	135.4	133.6	128.6
125	141.3	142.2	133.3	141.7	142.8	133.7	141.6	142.6	134.0
160	142.0	132.0	130.4	137.5	132.7	130.9	138.3	132.4	131.0
200	145.2	134.4	132.7	141.1	134.9	131.9	141.5	134.4	132.0
250	145.3	136.7	135.6	144.8	137.2	134.7	144.7	136.8	134.4
315	143.7	137.7	137.5	146.1	138.2	137.6	146.0	137.9	137.3
400	142.1	138.9	138.3	147.3	145.4	144.7	146.0	143.1	142.6
500	147.1	137.1	137.2	153.1	148.0	147.9	150.7	146.7	146.7
630	148.5	138.5	138.2	149.6	145.1	145.1	149.8	146.3	146.7
800	143.9	137.2	136.7	148.6	144.1	143.1	148.4	142.9	142.4
1000	146.7	137.2	136.5	145.6	143.7	143.1	144.6	142.1	142.4
1250	146.2	138.4	137.1	146.0	143.0	142.8	145.2	141.6	142.0
1600	144.7	138.6	139.4	143.3	142.6	142.7	142.7	141.2	141.8
2000	145.6	139.0	138.0	144.2	142.2	141.5	143.6	140.8	140.6
2500	148.1	137.8	137.4	148.4	139.4	141.3	147.9	138.1	140.8
3150	149.3	136.9	137.4	149.1	139.1	142.7	149.9	137.8	141.9
4000	139.3	134.9	132.8	138.4	136.5	140.4	138.2	135.1	138.8
5000	144.9	133.5	136.7	143.4	136.1	148.1	143.0	134.2	146.9
6300	150.2	134.3	139.2	146.9	137.2	141.5	146.7	134.7	143.6
8000	143.2	132.3	135.1	142.1	137.9	127.8	142.2	135.8	129.5
10000	134.7	125.7	124.5	134.2	130.5	122.4	134.4	130.2	123.2
OASPL	158.8	150.4	149.7	159.6	155.0	155.5	159.0	154.0	154.9

1/3 OCT FREQUENCY (HZ)	POINT # = 43 IDLE HOT INLET	LEFT SIDE	RIGHT SIDE	POINT # = 58 SLTO HOT INLET	LEFT SIDE	RIGHT SIDE	POINT # = 69 SLTO - HOT INLET	LEFT SIDE
50	131.3	128.5	124.0	144.4	131.0	130.2	157.7	131.5
63	132.0	132.5	126.7	143.8	133.3	128.0	158.6	134.3
80	134.5	132.3	130.1	143.2	133.3	130.9	158.9	133.2
100	135.8	133.8	128.4	145.3	138.3	135.2	159.8	136.9
125	142.0	142.6	133.9	146.7	143.4	133.8	160.1	143.8
160	138.3	133.1	130.9	147.1	136.6	134.9	159.8	135.1
200	142.3	135.0	132.5	148.2	136.7	134.4	159.5	135.4
250	145.5	137.6	135.1	149.5	138.1	136.2	159.4	137.2
315	146.2	138.8	137.6	151.5	139.1	138.7	160.0	138.2
400	147.3	147.4	146.2	151.5	141.6	140.6	160.5	140.9
500	153.6	150.3	149.9	151.1	144.5	143.6	161.6	144.4
630	150.0	146.2	146.6	153.7	147.4	147.0	164.0	147.0
800	148.3	144.5	143.7	153.3	149.1	147.9	164.4	147.4
1000	145.1	144.6	143.7	152.3	148.9	148.4	168.2	147.9
1250	145.7	144.3	143.7	148.9	148.9	149.1	169.9	148.0
1600	142.8	144.2	143.7	146.9	146.6	148.8	162.0	151.4
2000	144.1	143.3	142.0	146.6	148.6	147.7	159.0	151.7
2500	147.6	140.5	141.3	150.6	147.6	148.5	163.6	147.9
3150	149.4	140.0	141.9	152.5	144.7	151.8	160.1	146.6
4000	138.7	137.5	138.1	141.1	139.9	146.4	147.7	140.0
5000	143.6	136.8	144.3	146.1	139.3	152.4	150.8	139.7
6300	147.4	137.7	145.6	148.1	140.3	147.4	149.7	141.3
8000	142.5	139.3	135.5	145.5	140.0	133.9	138.3	140.9
10000	134.7	133.6	126.6	141.9	140.7	132.2	140.0	130.2
OASPL	159.7	156.3	156.2	163.1	156.3	159.8	175.8	158.8

1/3 OCT FREQUENCY (HZ)	POINT # = 810 SLTO - HOT INLET	LEFT SIDE	POINT # = 128 SLTO - HOT INLET	LEFT SIDE	POINT # = 2222 SLTO - COLD INLET	LEFT SIDE
50	151.6	136.3	141.2	129.5	141.0	128.4
63	152.1	137.1	141.9	131.5	141.4	130.4
80	152.8	141.9	142.4	134.6	141.7	133.7
100	153.8	141.9	143.9	134.2	143.8	131.0
125	154.5	139.3	145.1	136.4	144.7	136.4
160	154.6	139.6	146.8	134.8	145.7	133.1
200	154.9	138.9	147.8	135.4	146.4	133.5
250	156.2	139.6	149.0	137.0	149.1	134.7
315	157.6	141.8	151.0	138.0	151.5	136.8
400	159.2	146.0	151.6	141.3	151.2	139.6
500	160.6	148.7	151.5	145.0	150.1	140.3
630	161.6	148.9	152.7	147.2	150.3	140.8
800	162.6	150.6	153.6	147.7	153.1	140.9
1000	165.3	150.3	163.7	147.6	161.4	140.4
1250	168.4	149.3	163.9	146.6	163.2	138.2
1600	156.4	149.6	156.6	147.7	153.8	142.3
2000	154.2	150.0	151.9	147.9	150.1	142.7
2500	160.9	147.7	152.1	147.6	152.9	143.0
3150	156.4	144.1	151.8	143.3	152.0	140.3
4000	145.5	139.9	141.3	139.1	140.9	135.4
5000	149.4	138.6	144.7	137.6	144.7	137.1
6300	147.6	137.4	145.4	136.8	145.2	131.1
8000	137.7	137.3	138.2	138.2	137.5	132.6
10000	139.7	137.8	140.7	140.0	140.2	133.1
OASPL	173.2	159.5	168.4	157.2	167.2	152.0

1/3 OCTAVE SPL LEVEL CORRECTED 50-5000 Hz ONLY

SWIRL VORBIX COMBUSTOR S-9 15% PILOT SWIRLERS BLOCKED

1/3 OCT FREQUENCY (HZ)	POINT # = 1 COLD FLOW IDLE INLET	LEFT SIDE	RIGHT SIDE	POINT # = 21 IDLE HOT INLET	LEFT SIDE	RIGHT SIDE	POINT # = 32 IDLE HOT INLET	LEFT SIDE	RIGHT SIDE
50	161.6	166.4	152.3	160.5	170.6	149.8	160.0	171.0	149.5
63	162.4	167.4	153.1	160.7	171.1	150.5	160.5	170.7	150.7
80	162.7	167.6	153.5	161.1	171.2	151.9	160.7	170.7	151.8
100	162.9	167.9	153.9	161.3	170.3	152.4	160.4	170.5	153.3
125	163.2	167.5	154.6	162.4	170.2	152.8	161.5	170.2	153.7
160	163.1	167.2	154.6	162.7	169.9	153.1	161.7	169.8	153.2
200	162.8	166.9	154.6	162.3	169.6	153.2	161.2	169.7	153.2
250	162.3	167.2	154.8	162.1	170.1	153.6	160.8	170.0	153.4
315	161.1	167.8	154.5	161.1	171.2	154.6	160.3	171.2	154.2
400	160.5	169.5	154.2	160.0	173.2	155.1	159.4	173.1	154.3
500	160.2	170.9	154.2	159.6	174.3	153.4	159.1	174.2	153.3
630	159.4	170.7	154.3	158.2	172.5	153.4	157.7	172.6	153.2
800	158.3	168.0	154.9	157.8	169.6	153.9	157.1	169.5	153.8
1000	156.4	164.6	155.2	157.4	166.1	153.7	156.6	166.2	153.4
1250	155.2	162.1	155.0	159.7	163.2	153.3	159.0	163.5	153.2
1600	155.1	162.6	157.6	156.2	163.0	157.3	155.3	163.2	157.7
2000	153.4	160.7	154.1	154.5	162.4	153.2	153.9	162.3	153.5
2500	152.5	153.8	150.3	153.6	154.4	148.6	153.2	154.4	148.8
3150	145.8	148.5	150.9	148.2	151.0	147.8	147.3	151.4	148.2
4000	140.1	146.5	147.2	142.6	148.5	146.3	141.9	148.7	146.8
5000	138.3	144.9	143.9	140.4	146.9	145.5	139.7	146.7	145.9
6200	125.4	142.4	144.9	127.1	145.2	146.4	127.0	144.7	146.9
8000	134.7	134.9	149.3	136.4	138.5	151.0	136.8	138.2	151.3
10000	124.3	39.6	142.1	125.9	121.9	145.0	126.3	131.9	145.1
OASPL	173.3	179.8	167.2	172.7	182.7	166.3	172.0	182.7	166.4

1/3 OCT FREQUENCY (HZ)	POINT # = 43 IDLE HOT INLET	LEFT SIDE	RIGHT SIDE	POINT # = 69 SLTO HOT INLET	RIGHT SIDE	POINT # = 1145 SLTO HOT INLET	RIGHT SIDE
50	158.4	171.0	149.2	151.4	163.0	152.8	161.2
63	156.9	171.2	150.4	152.1	163.6	152.9	161.9
80	160.0	171.3	151.8	152.5	164.0	153.8	162.1
100	160.7	170.7	153.6	153.9	164.1	155.3	162.3
125	162.1	170.2	154.1	155.1	164.3	156.5	162.8
160	163.2	170.2	153.6	155.5	164.1	156.9	162.7
200	163.4	170.1	153.3	156.1	163.2	156.8	162.3
250	163.4	170.3	153.5	156.5	162.5	156.8	161.7
315	162.5	171.5	155.2	157.4	161.4	157.5	160.9
400	161.0	173.5	155.4	158.0	159.9	158.4	155.7
500	159.9	174.4	153.2	158.6	158.6	158.7	158.7
630	158.3	172.7	153.4	159.3	157.8	159.1	157.5
800	157.5	169.6	154.4	159.2	156.6	159.2	156.9
1000	156.8	166.4	154.0	160.4	156.5	161.0	156.8
1250	159.3	163.4	153.7	163.5	156.9	164.7	157.4
1600	155.5	162.8	157.3	162.1	158.8	163.1	159.2
2000	153.6	162.4	153.7	153.1	157.9	153.4	158.1
2500	153.1	154.5	148.8	151.9	152.4	151.9	152.7
3150	147.1	151.4	147.9	150.4	154.8	149.5	154.9
4000	141.4	149.0	146.5	145.7	150.5	145.0	151.0
5000	139.5	147.4	145.6	143.5	148.1	143.1	149.4
6300	126.8	145.8	146.5	128.8	150.1	128.0	147.8
8000	136.3	139.0	151.1	135.7	146.5	135.3	142.0
10000	125.9	132.4	145.3	126.5	137.6	126.4	136.2
OASPL	172.8	182.9	166.6	170.6	174.1	171.2	173.1

1/3 OCTAVE SPL LEVEL CORRECTED 50-5000 Hz ONLY

ORIGINAL PAGE IS
OF POOR QUALITY

SWIRL VORBIX COMBUSTOR S-9 15% PILOT SWIRLERS BLOCKED

1/3 OCT FREQUENCY (HZ)	POINT # = 1030 SLTO HOT INLET	POINT # = 1030 SLTO HOT RIGHT SIDE	POINT # = 710 SLTO HOT INLET	POINT # = 710 SLTO HOT RIGHT SIDE	POINT # = 58 SLTO HOT INLET	POINT # = 58 SLTO HOT RIGHT SIDE
50	152.1	162.7	152.0	160.6	151.7	159.4
63	152.9	163.5	152.3	161.1	152.7	159.7
80	154.0	163.8	153.4	160.8	153.6	159.6
100	154.6	163.4	154.6	160.9	154.5	159.5
125	156.0	163.6	156.1	160.9	155.9	160.0
160	156.1	163.4	156.3	160.7	156.1	159.7
200	156.7	163.0	156.4	160.2	156.4	159.9
250	156.6	162.8	156.5	160.1	156.3	159.9
315	157.6	161.6	157.7	159.8	157.6	159.9
400	157.6	160.3	158.2	158.8	157.9	159.3
500	158.2	159.1	159.2	158.4	158.5	158.5
630	158.7	158.2	160.6	157.8	159.2	157.7
800	158.8	157.3	160.4	156.9	159.3	156.6
1000	160.5	157.1	161.2	156.8	161.4	156.8
1250	164.5	157.5	164.2	157.4	164.3	157.4
1600	162.6	155.4	162.6	159.2	162.7	159.1
2000	152.9	158.2	153.1	158.2	153.1	157.7
2500	151.5	152.7	151.3	152.6	151.3	152.5
3150	149.2	154.5	148.5	155.2	148.5	155.1
4000	146.5	158.5	144.2	151.2	143.9	150.6
5000	142.7	150.8	142.6	150.3	147.3	150.8
6300	127.7	146.7	127.8	151.5	127.4	151.0
8000	135.2	140.9	135.1	144.7	135.1	143.7
10000	126.3	135.6	126.3	137.4	126.3	137.2
OASPL	170.9	174.0	171.2	172.1	171.0	171.6

1/3 OCT FREQUENCY (HZ)	POINT # = 128 AST HOT INLET	POINT # = 128 AST HOT RIGHT SIDE	POINT # = 712 SLTO COLD INLET	POINT # = 712 SLTO COLD RIGHT SIDE
50	150.9	157.7	154.4	160.8
63	151.5	158.3	155.2	161.3
80	152.8	159.1	156.3	162.1
100	153.9	159.4	157.6	162.3
125	155.1	159.8	158.6	162.5
160	155.3	159.8	159.4	162.5
200	155.3	159.9	160.3	161.5
250	156.0	159.8	161.8	161.1
315	156.8	159.4	163.2	160.8
400	158.3	159.3	164.6	160.5
500	159.0	159.1	165.2	159.3
630	160.1	159.1	164.1	157.6
800	160.5	157.9	163.0	156.2
1000	163.2	157.8	162.4	155.5
1250	167.8	157.8	165.1	156.1
1600	167.4	159.6	165.7	158.9
2000	157.1	158.8	160.6	158.1
2500	158.2	153.1	160.1	152.1
3150	154.0	154.4	153.7	154.3
4000	148.0	150.2	147.8	149.5
5000	146.0	147.3	146.2	145.9
6300	130.4	149.0	131.0	146.0
8000	137.2	152.7	137.4	151.4
10000	127.3	143.5	127.1	147.4
OASPL	173.3	171.6	174.7	172.9

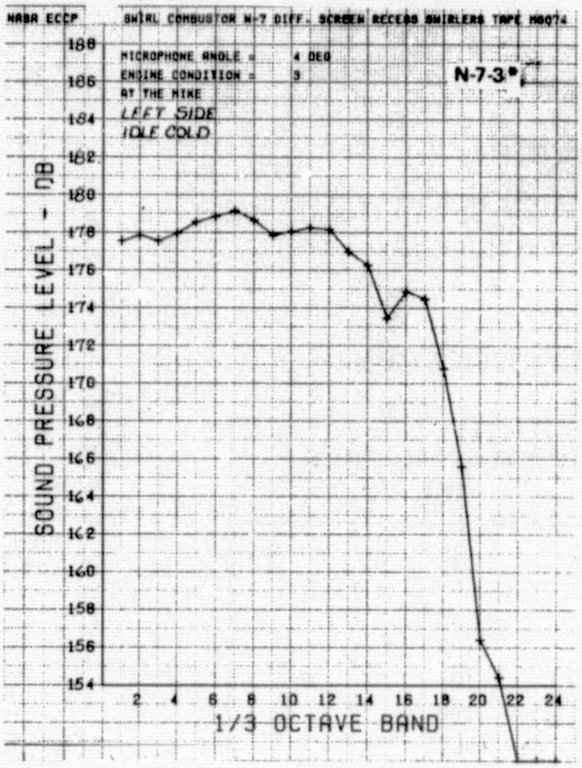
1/3 OCTAVE SPL LEVEL CORRECTED 50-5000 Hz ONLY

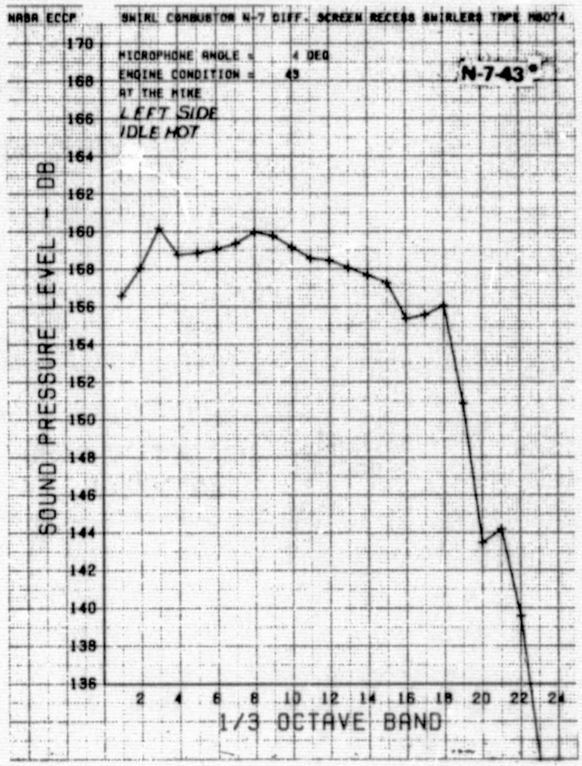
APPENDIX D

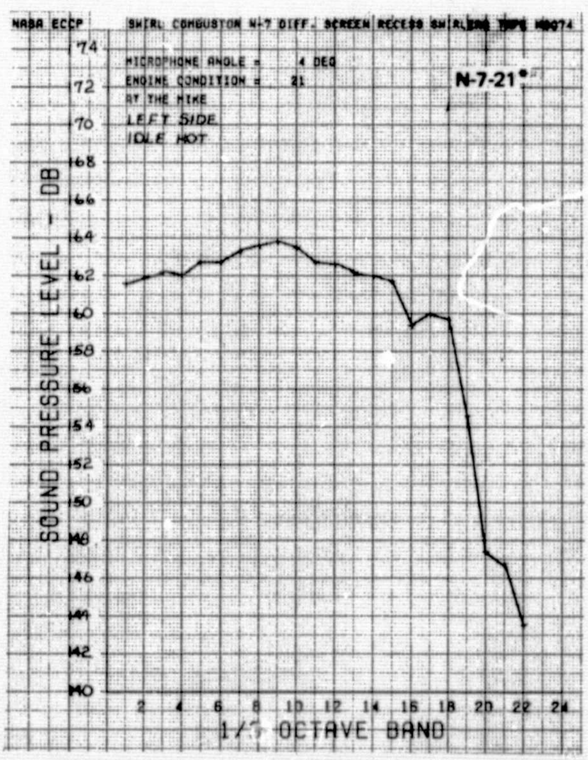
1/3 OCTAVE SPECTRA

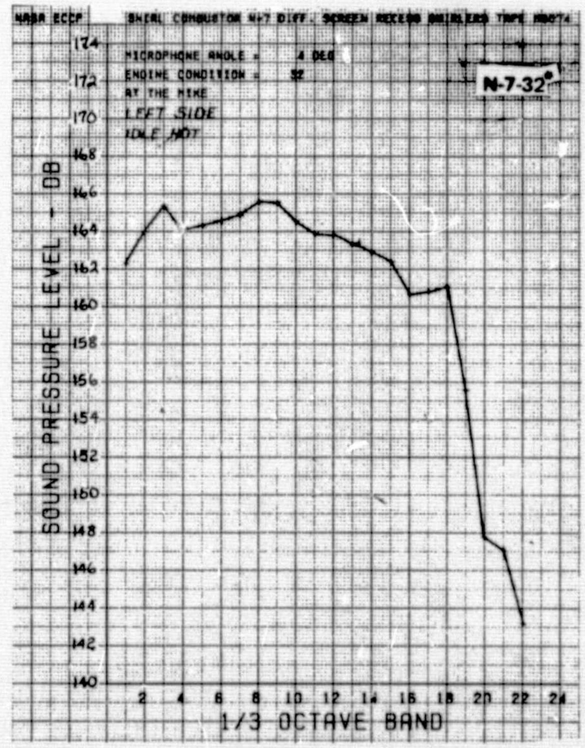
1/3 OCTAVE BAND IDENTIFICATION

1/3 OCTAVE BAND (NUMBER)	CENTER FREQUENCY (H_2)
1	50
2	63
3	80
4	100
5	125
6	160
7	200
8	250
9	315
10	400
11	500
12	630
13	800
14	1000
15	1250
16	1600
17	2000
18	2500
19	3150
20	4000
21	5000
22	6300
23	8000
24	10000

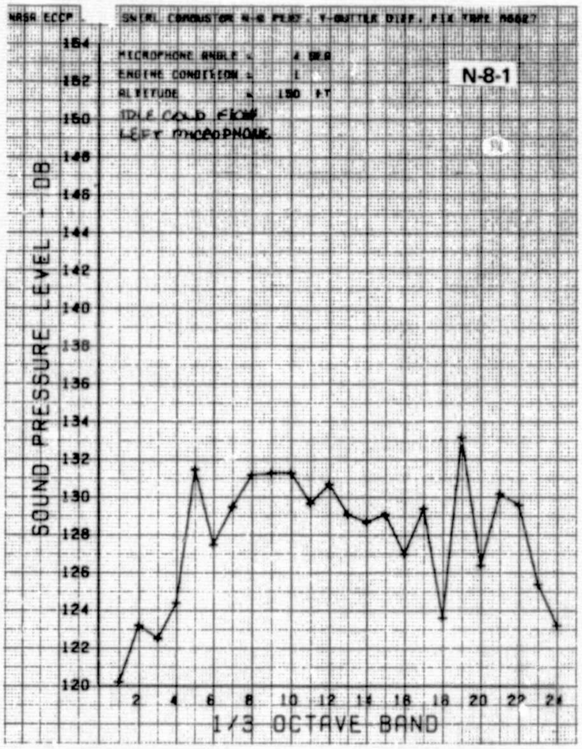


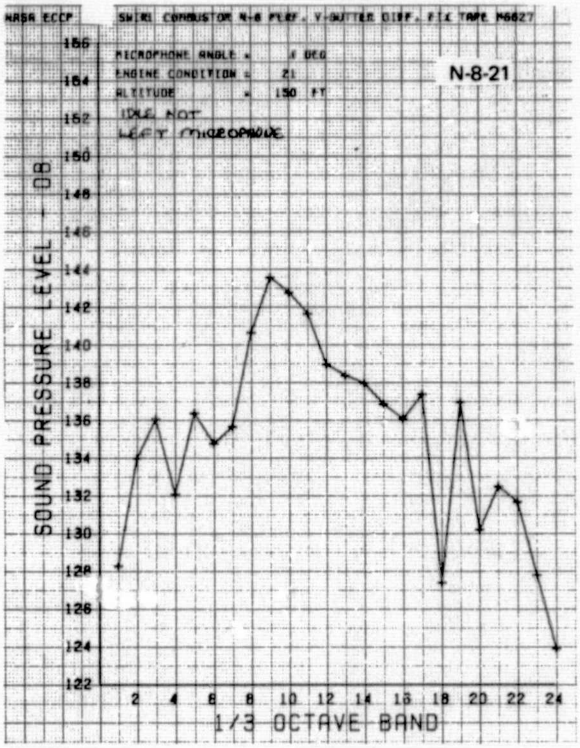


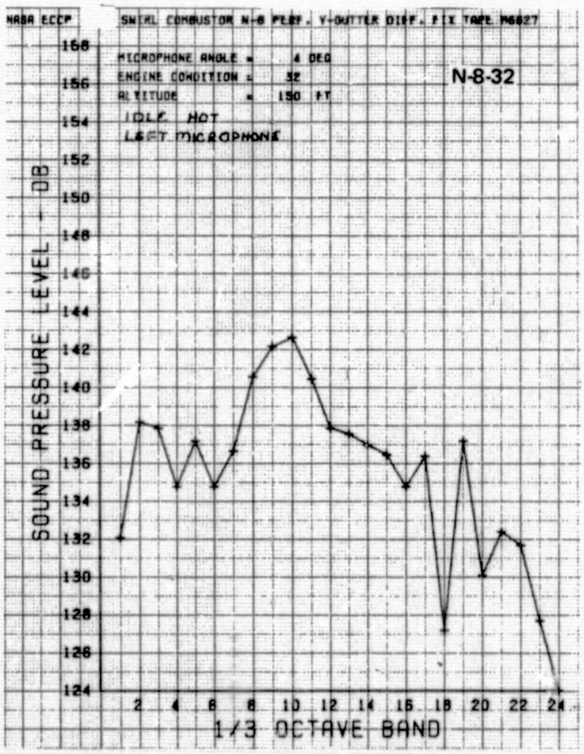


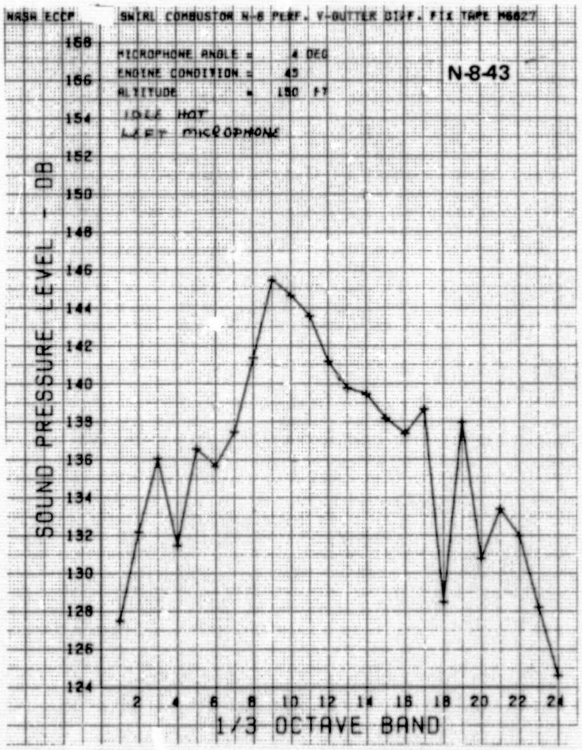


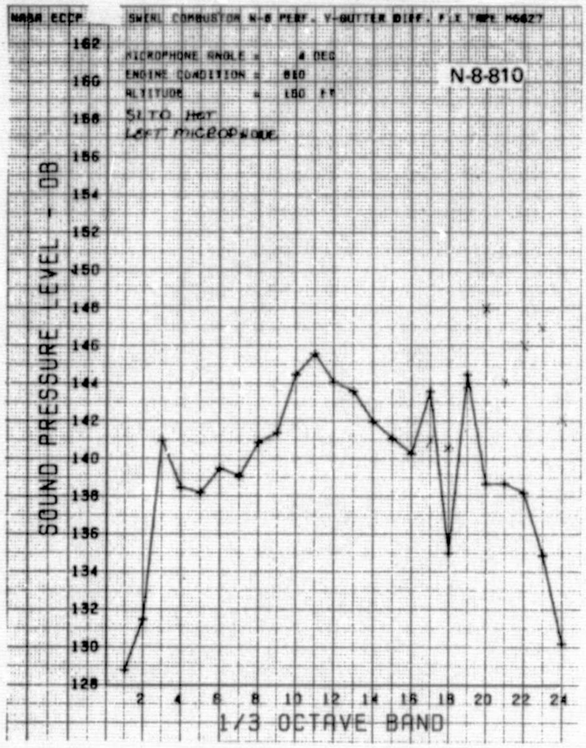
***These numbers on each curve indicate configuration and run number.**

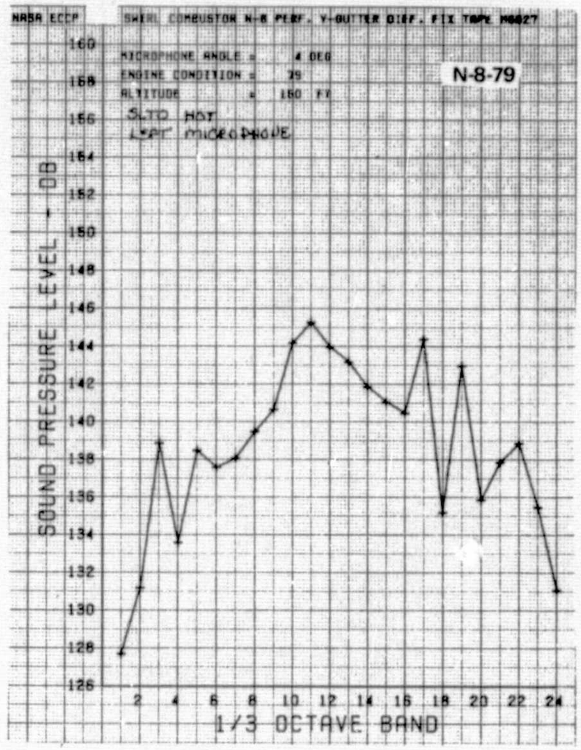

NASA ECCP
SWIRL COMBUSTOR N-8 PERF. V-GUTTER DIFF. FIX TAPE M6827
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 1
ALTITUDE = 150 FT
IDLE COLD FLOW
LEFT MICROPHONE
N-8-1
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

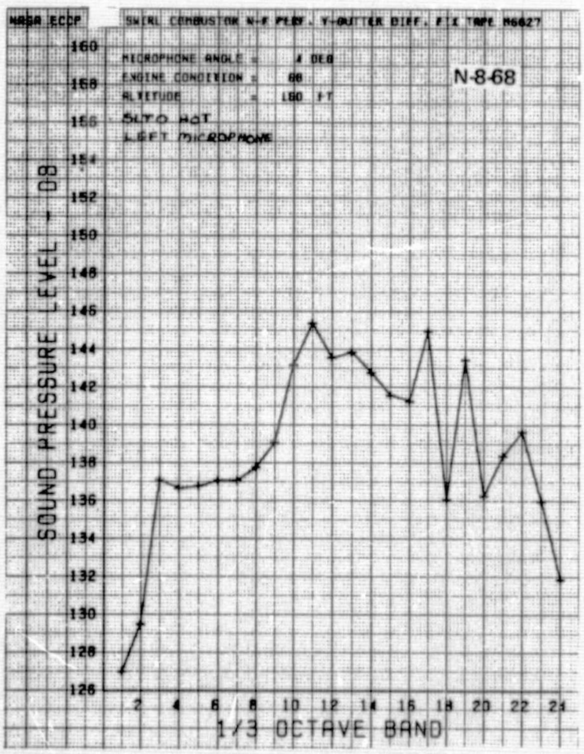

NASA ECCP
SWIRL COMBUSTOR N-8 PERF. V-GUTTER DIFF. FIX TAPE M6827
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 21
ALTITUDE = 150 FT
IDLE HOT
LEFT MICROPHONE
N-8-21
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

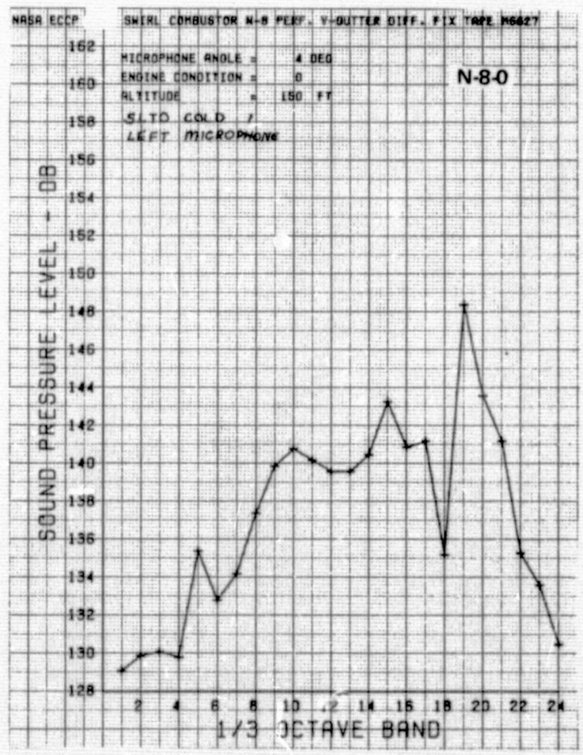

NASA ECCP
SWIRL COMBUSTOR N-8 PERF. V-GUTTER DIFF. FIX TAPE M6827
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 32
ALTITUDE = 150 FT
IDLE HOT
LEFT MICROPHONE
N-8-32
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

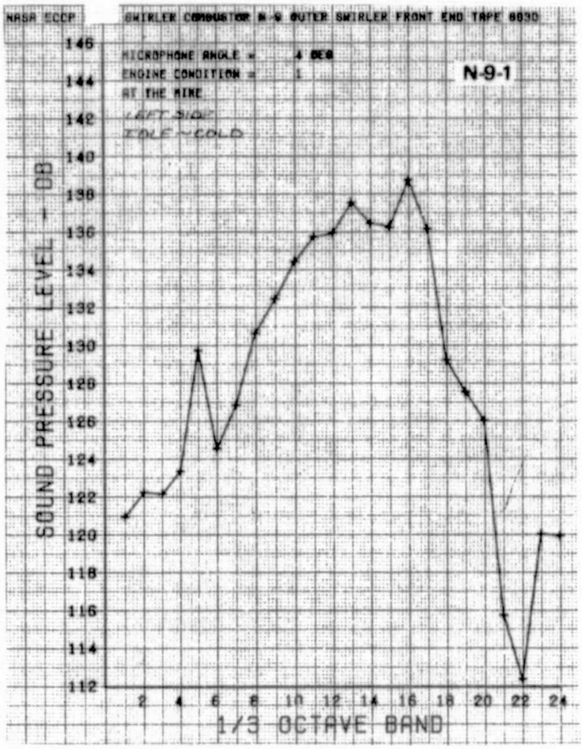

NASA ECCP
SWIRL COMBUSTOR N-8 PERF. V-GUTTER DIFF. FIX TAPE M6827
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 43
ALTITUDE = 150 FT
IDLE HOT
LEFT MICROPHONE
N-8-43
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

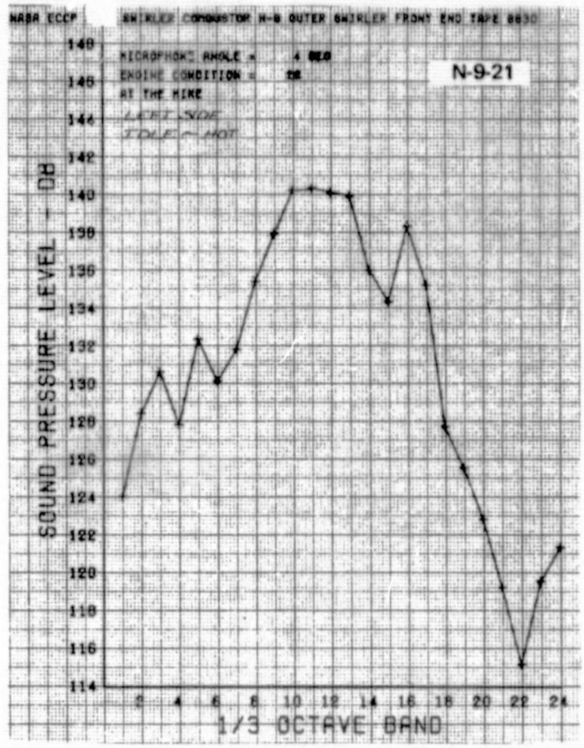

NASA ECCP
SWIRL COMBUSTOR N-8 PERF. Y-GUTTER DIFF. FIX TAPE M6627
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 810
ALTITUDE = 150 FT
SLTO HOT
LEFT MICROPHONE
N-8-810
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

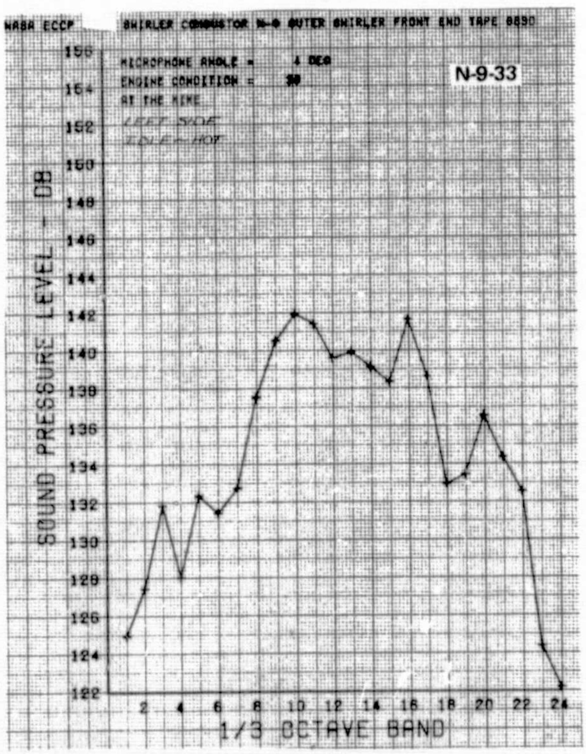

NASA ECCP
SWIRL COMBUSTOR N-8 PERF. Y-GUTTER DIFF. FIX TAPE M6627
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 79
ALTITUDE = 150 FT
SLTO HOT
LEFT MICROPHONE
N-8-79
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

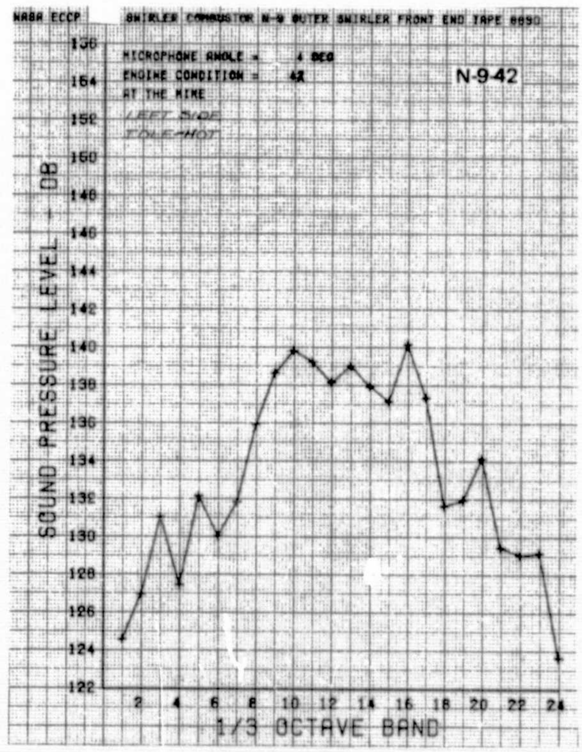

NASA ECCP
SWIRL COMBUSTOR N-8 PERF. Y-GUTTER DIFF. FIX TAPE M6627
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 68
ALTITUDE = 150 FT
SLTO HOT
LEFT MICROPHONE
N-8-68
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

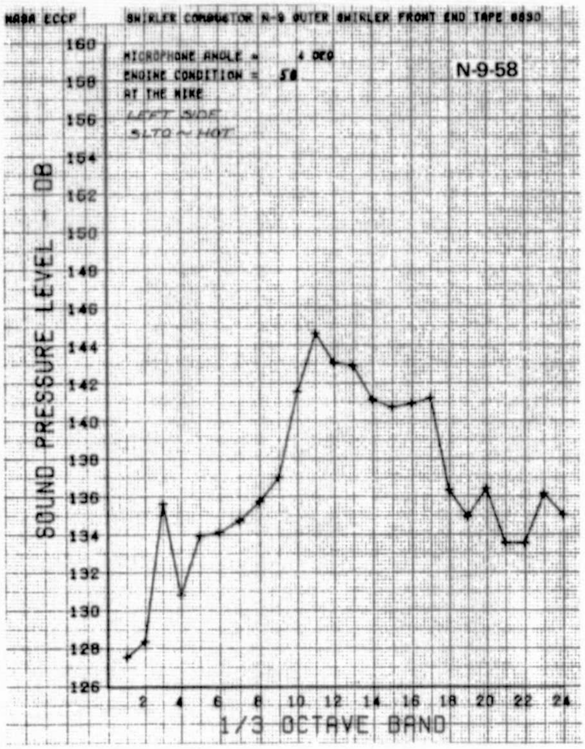

NASA ECCP
SWIRL COMBUSTOR N-8 PERF. Y-GUTTER DIFF. FIX TAPE M6627
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 0
ALTITUDE = 150 FT
SLTO COLD
LEFT MICROPHONE
N-8-0
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

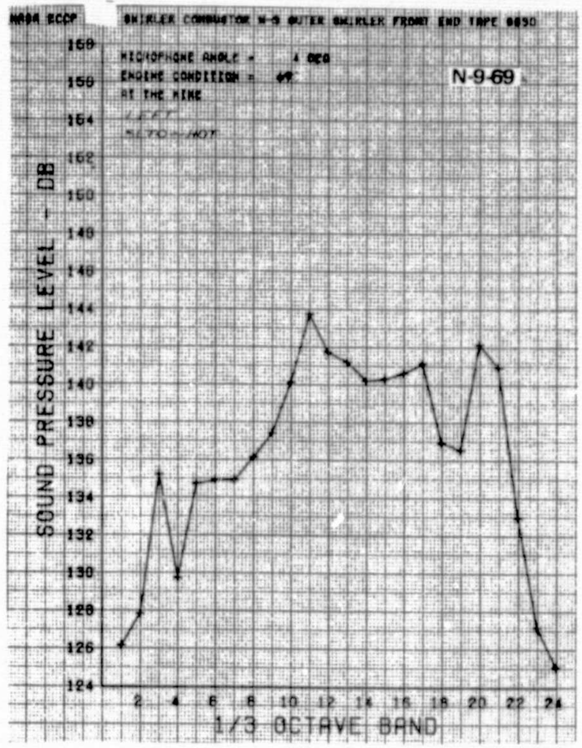

NASA ECCP
SWIRLER COMBUSTOR N-9 OUTER SWIRLER FRONT END TAPE 8830
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 1
AT THE MIKE
LEFT SIDE
IDLE ~ COLD
N-9-1
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

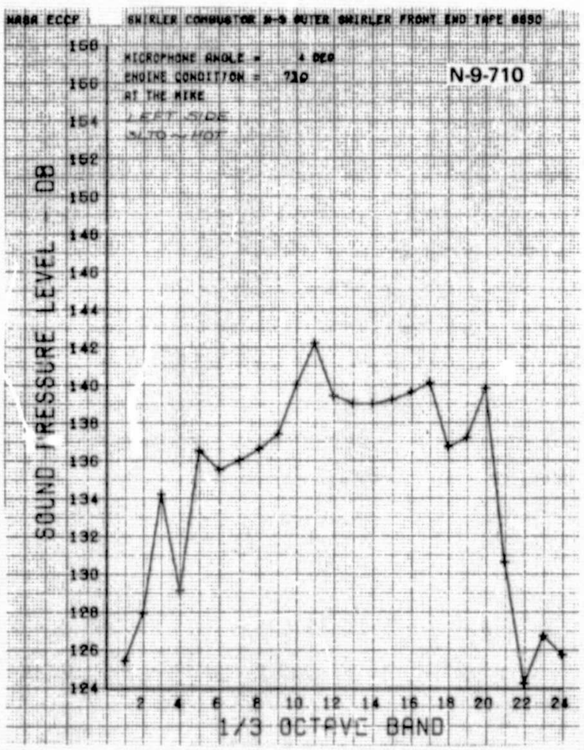

NASA ECCP
SWIRLER COMBUSTOR N-9 OUTER SWIRLER FRONT END TAPE 8830
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 21
AT THE MIKE
LEFT SIDE
IDLE ~ HOT
N-9-21
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

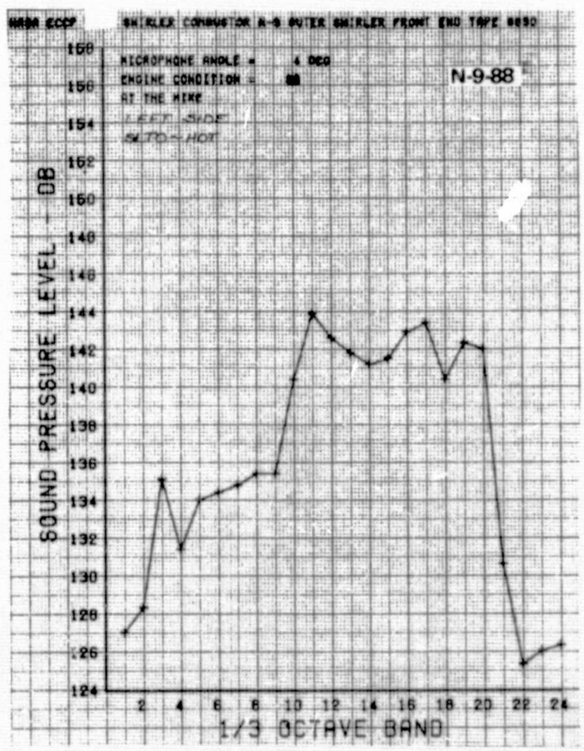

NASA ECCP
SWIRLER COMBUSTOR N-9 OUTER SWIRLER FRONT END TAPE 8830
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 33
AT THE MIKE
LEFT SIDE
IDLE ~ HOT
N-9-33
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

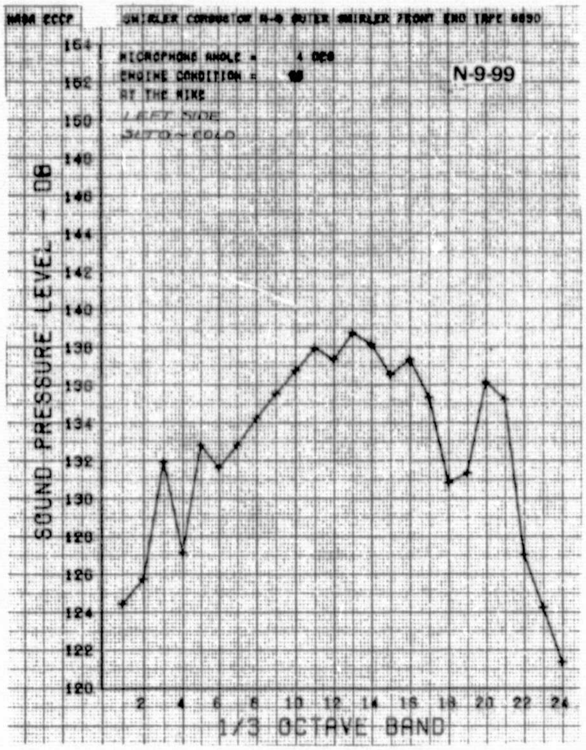

NASA ECCP
SWIRLER COMBUSTOR N-9 OUTER SWIRLER FRONT END TAPE 8830
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 42
AT THE MIKE
LEFT SIDE
IDLE ~ HOT
N-9-42
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

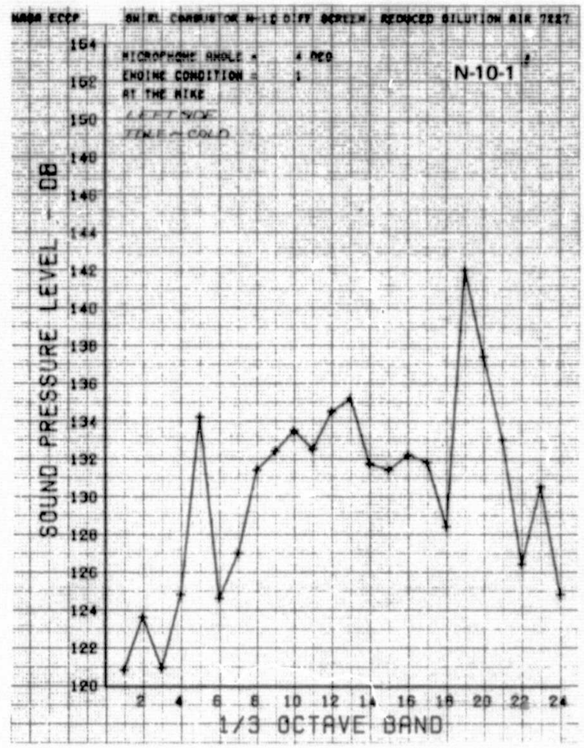

NASA ECCP
SWIRLER COMBUSTOR N-9 OUTER SWIRLER FRONT END TAPE 8830
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 58
AT THE MIKE
LEFT SIDE
SLTO ~ HOT
N-9-58
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

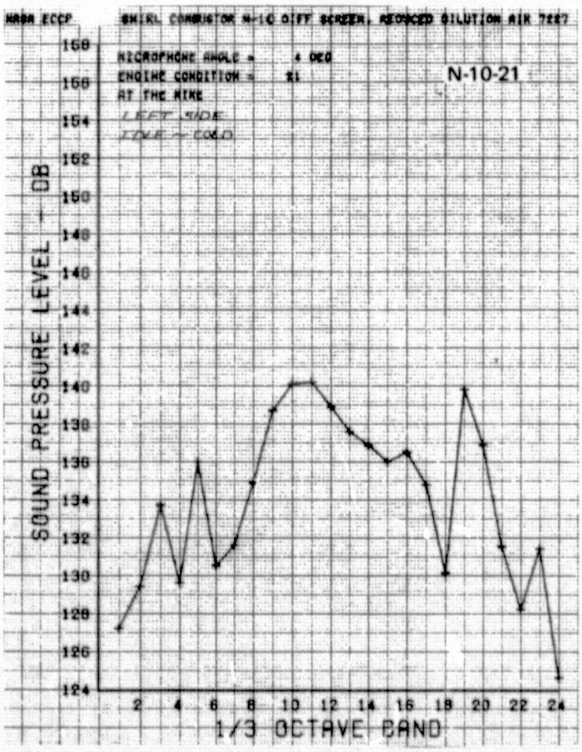

NASA ECCP
SWIRLER COMBUSTOR N-9 OUTER SWIRLER FRONT END TAPE 8830
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION =
AT THE MIKE
LEFT
SLTO ~ HOT
N-9-69
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

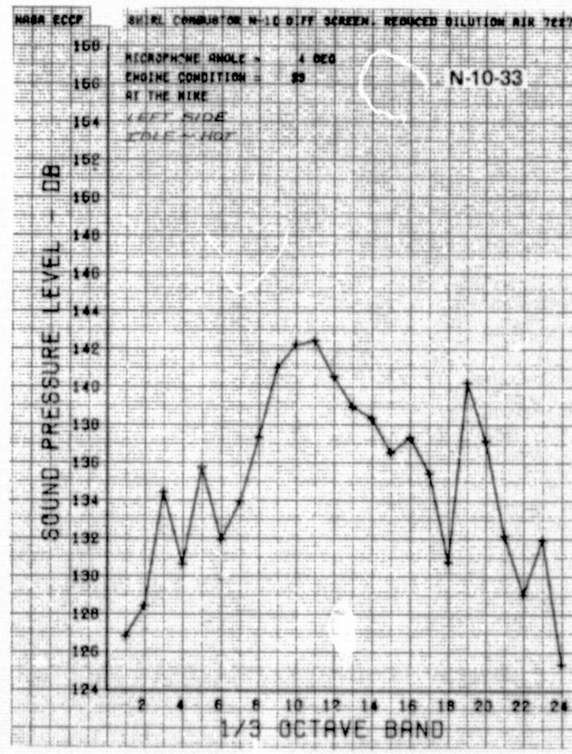

NASA ECCP
SWIRLER COMBUSTOR N-9 OUTER SWIRLER FRONT END TAPE 8830
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 710
AT THE MIKE
LEFT SIDE
SLTO ~ HOT
N-9-710
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

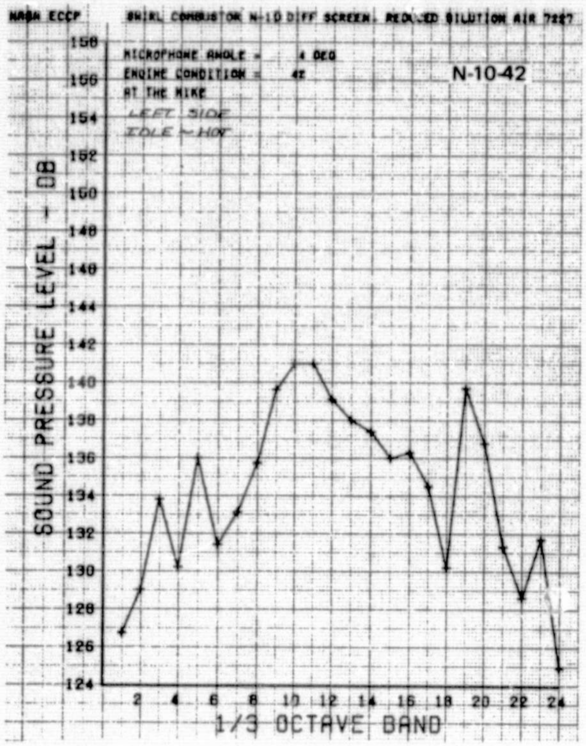

NASA ECCP
SWIRLER COMBUSTOR N-9 OUTER SWIRLER FRONT END TAPE 8830
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION =
AT THE MIKE
LEFT SIDE
SLTO ~ HOT
N-9-88
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

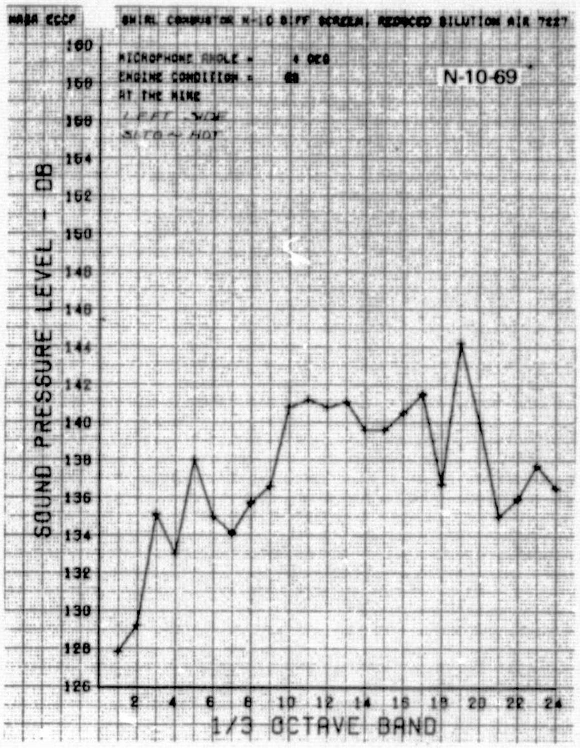

NASA ECCP
SWIRLER COMBUSTOR N-9 OUTER SWIRLER FRONT END TAPE 8890
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION =
AT THE MIKE
LEFT SIDE
N-9-99
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

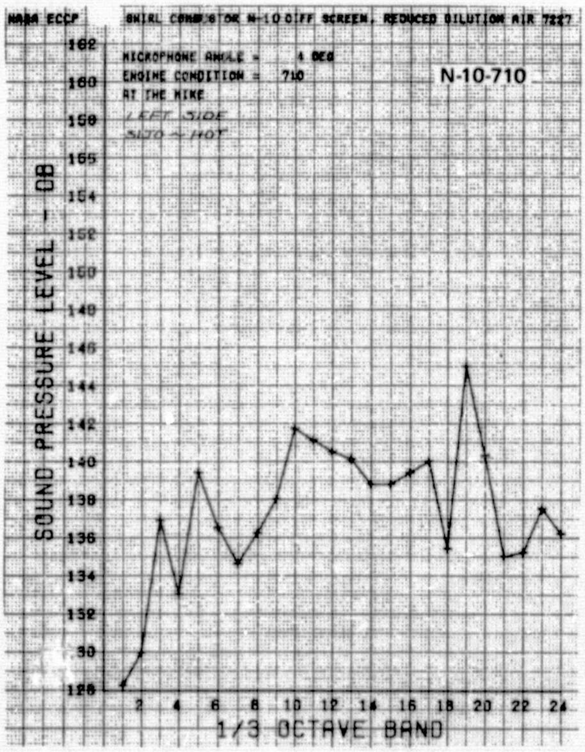

NASA ECCP
SWIRL COMBUSTOR N-10 DIFF SCREEN, REDUCED DILUTION AIR 7227
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 1
AT THE MIKE
LEFT SIDE
IDLE ~ COLD
N-10-1
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

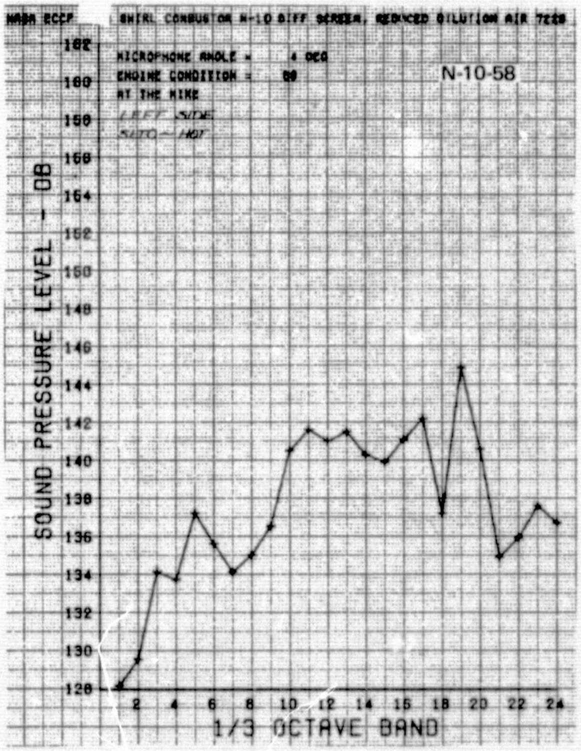

NASA ECCP
SWIRL COMBUSTOR N-10 DIFF SCREEN, REDUCED DILUTION AIR 7227
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 21
AT THE MIKE
LEFT SIDE
IDLE ~ COLD
N-10-21
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

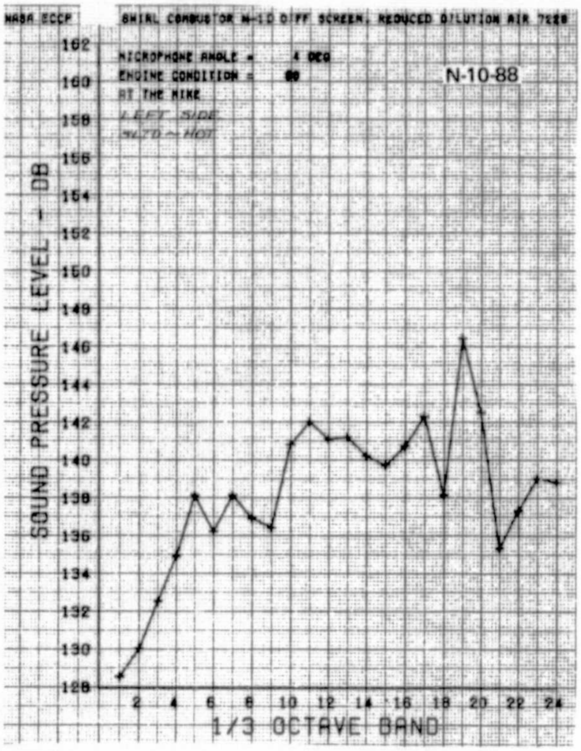

NASA ECCP
SWIRL COMBUSTOR N-10 DIFF SCREEN, REDUCED DILUTION AIR 7227
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION =
AT THE MIKE
LEFT SIDE
IDLE ~ HOT
N-10-33
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

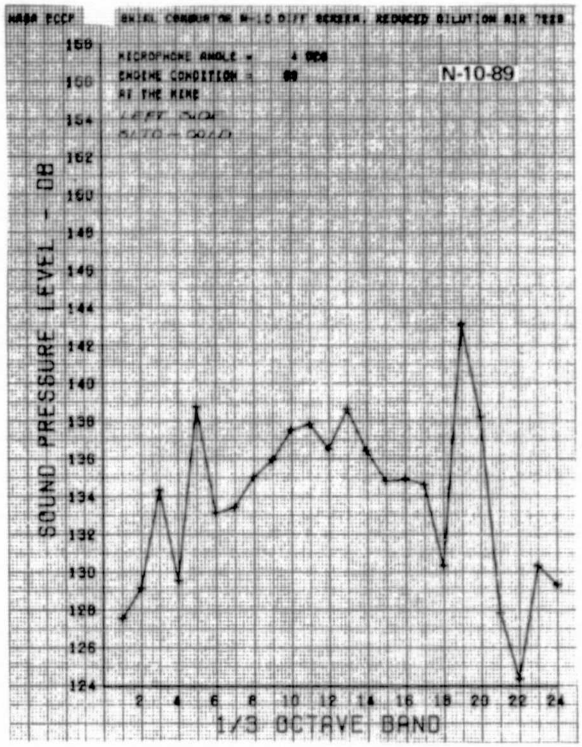

NASA ECCP
SWIRL COMBUSTOR N-10 DIFF SCREEN, REDUCED DILUTION AIR 7227
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 42
AT THE MIKE
LEFT SIDE
IDLE ~ HOT
N-10-42
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

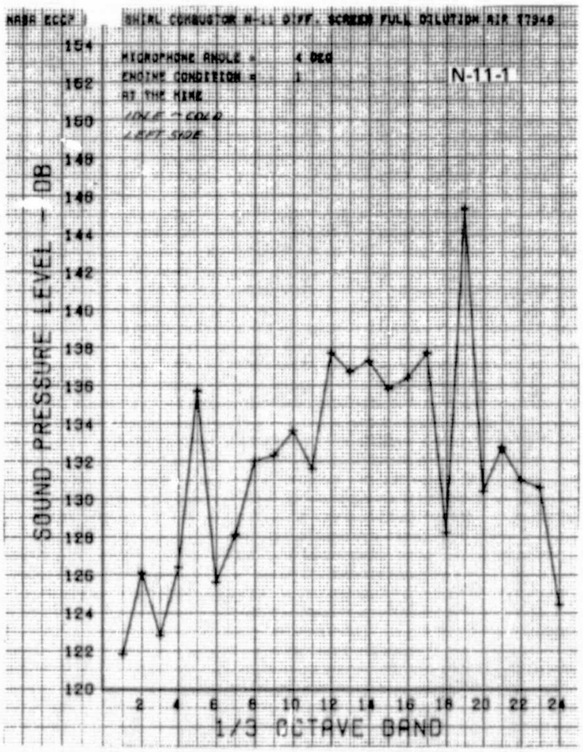

NASA ECCP
SWIRL COMBUSTOR N-10 DIFF SCREEN, REDUCED DILUTION AIR 7227
MICROPHONE ANGLE = 4 DEG
AT THE MIKE
LEFT SIDE
N-10-69
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

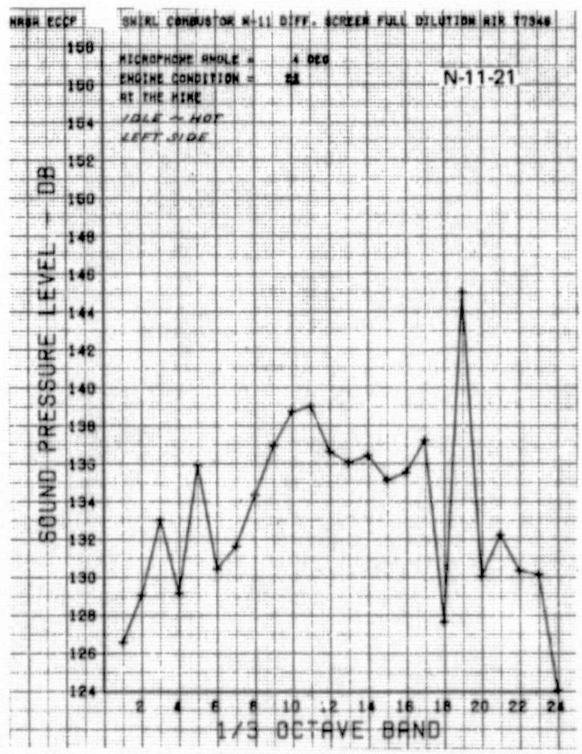

NASA ECCP
SWIRL COMBUSTOR N-10 DIFF SCREEN, REDUCED DILUTION AIR 7227
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 710
AT THE MIKE
LEFT SIDE
N-10-710
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

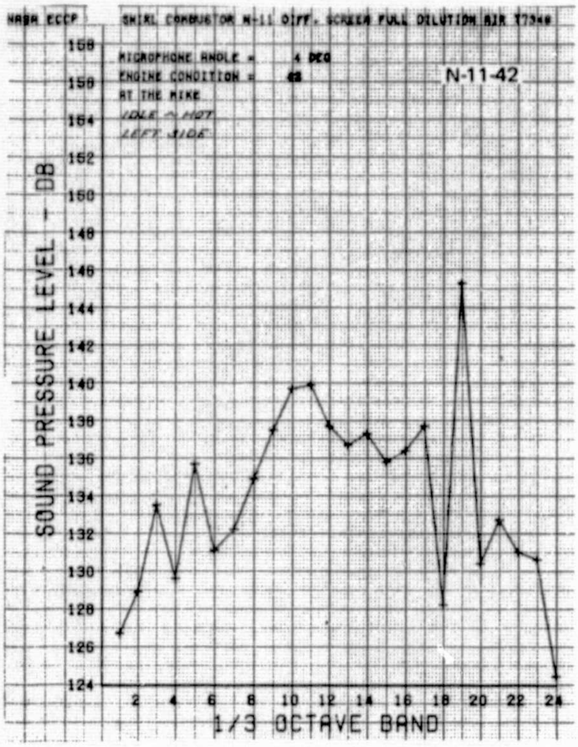

NASA ECCP
SWIRL COMBUSTOR N-10 DIFF SCREEN, REDUCED DILUTION AIR 7228
MICROPHONE ANGLE = 4 DEG
AT THE MIKE
N-10-58
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

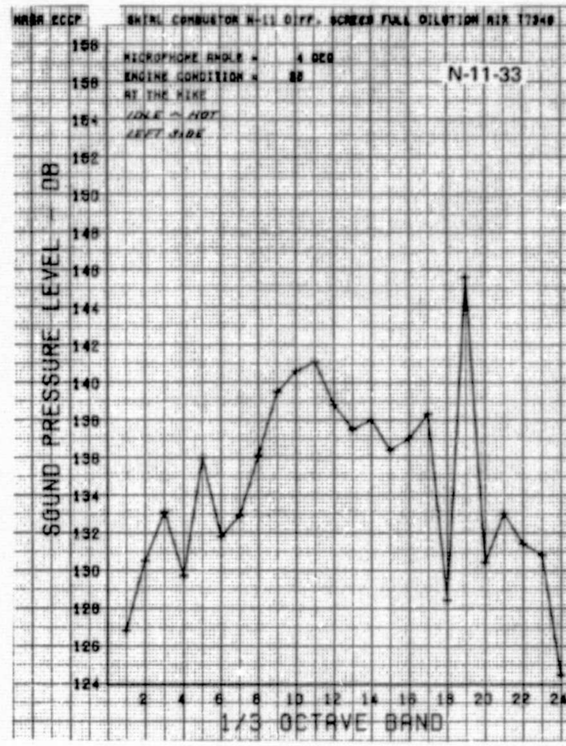

NASA ECCP
SWIRL COMBUSTOR N-10 DIFF SCREEN, REDUCED DILUTION AIR 7228
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 80
AT THE MIKE
LEFT SIDE
N-10-88
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

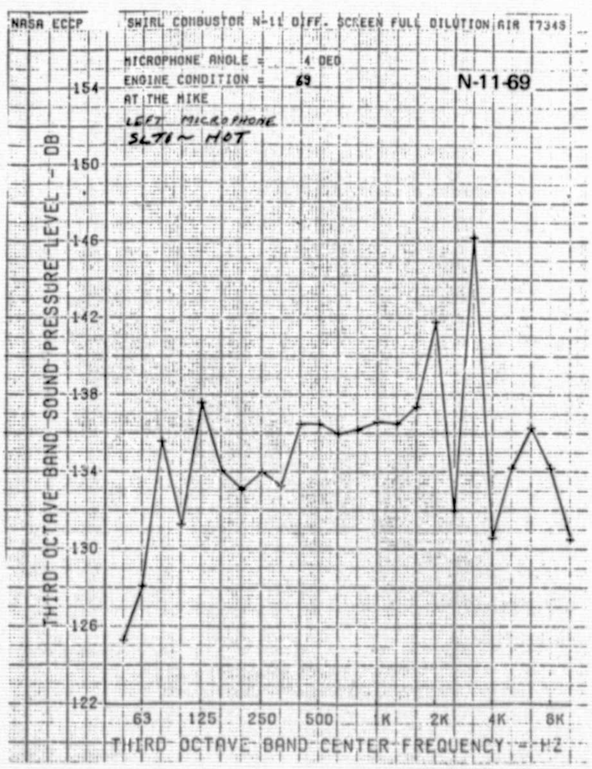

NASA ECCP
SWIRL COMBUSTOR N-10 DIFF SCREEN, REDUCED DILUTION AIR 7228
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 80
AT THE MIKE
LEFT SIDE
N-10-89
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

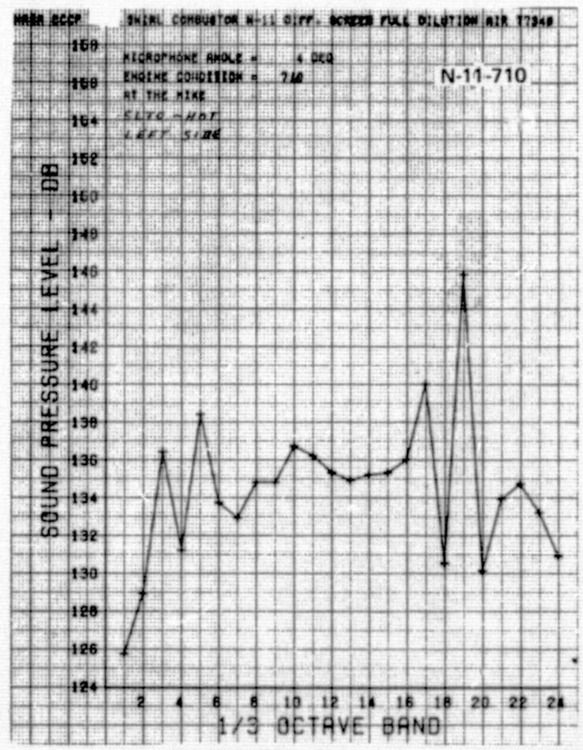

NASA ECCP
SWIRL COMBUSTOR N-11 DIFF. SCREEN FULL DILUTION AIR 7746
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 1
AT THE MIKE
IDLE ~ COLD
LEFT SIDE
N-11-1
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

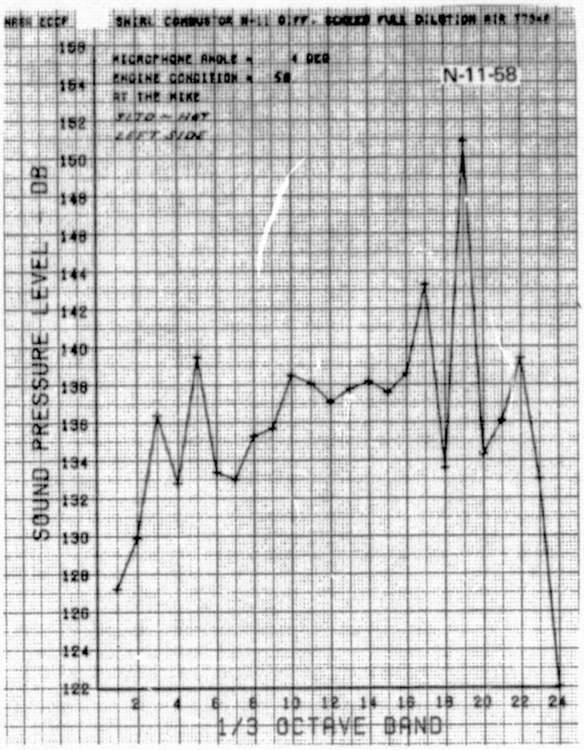

NASA ECCP
SWIRL COMBUSTOR N-11 DIFF. SCREEN FULL DILUTION AIR 7746
MICROPHONE ANGLE = 4 DEG
AT THE MIKE
IDLE ~ HOT
LEFT SIDE
N-11-21
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

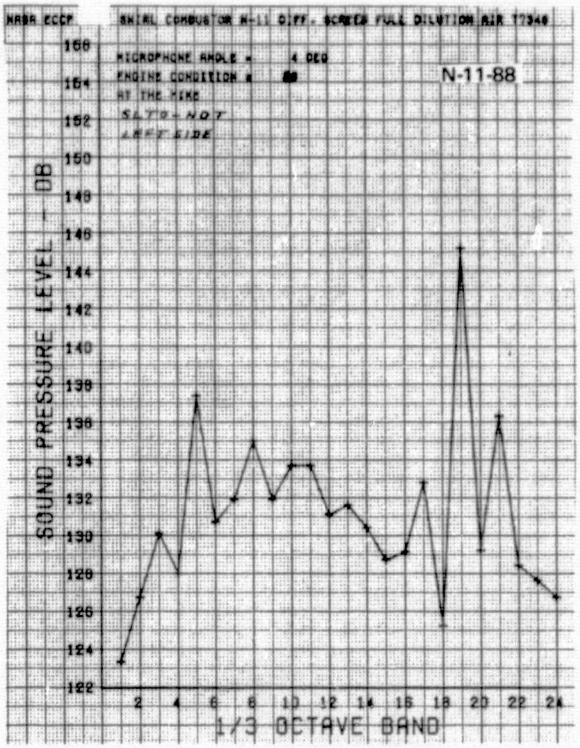

NASA ECCP
SWIRL COMBUSTOR N-11 DIFF. SCREEN FULL DILUTION AIR
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION =
AT THE MIKE
IDLE ~ HOT
LEFT SIDE
N-11-42
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

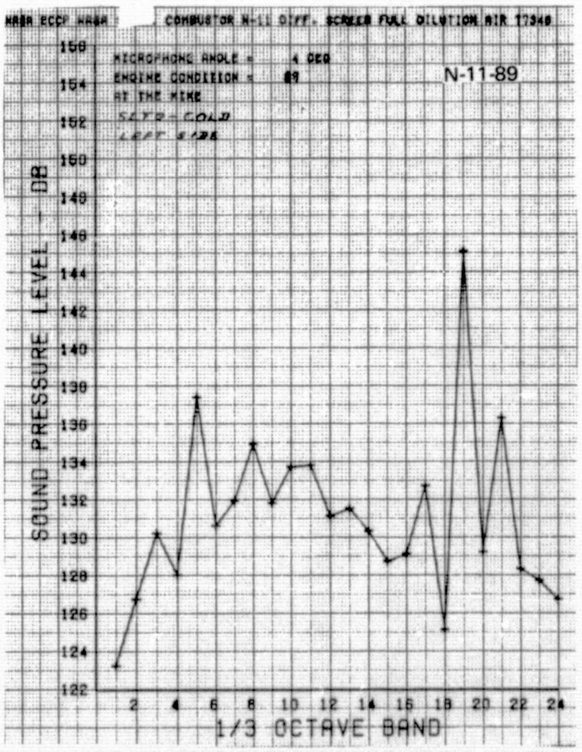

NASA ECCP
SWIRL COMBUSTOR N-11 DIFF. SCREEN FULL DILUTION AIR
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION =
AT THE MIKE
IDLE ~ HOT
LEFT SIDE
N-11-33
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

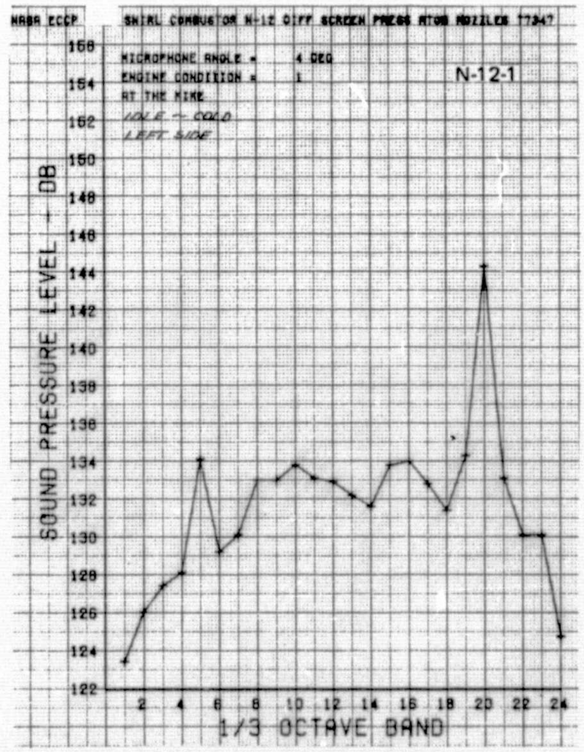

NASA ECCP
SWIRL COMBUSTOR N-11 DIFF. SCREEN FULL DILUTION AIR T7345
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 69
AT THE MIKE
LEFT MICROPHONE
SLTI ~ HOT
N-11-69
THIRD-OCTAVE-BAND SOUND-PRESSURE-LEVEL - DB
THIRD OCTAVE BAND CENTER FREQUENCY - HZ

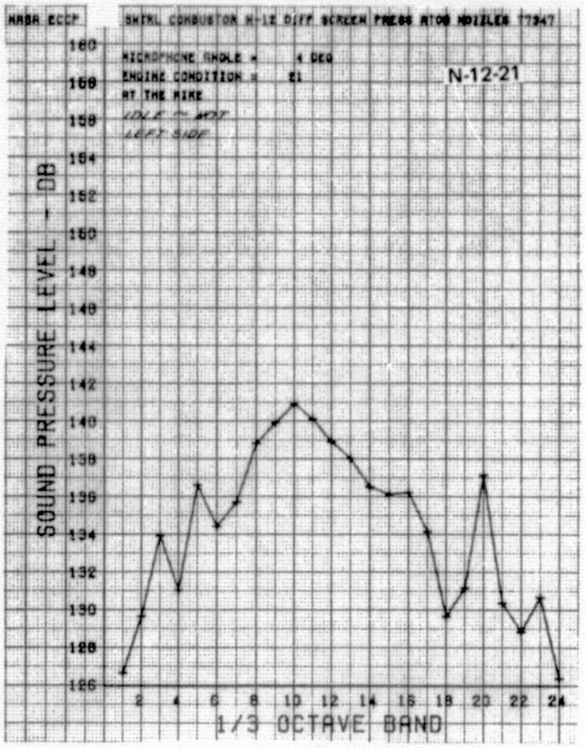

NASA ECCP
SWIRL COMBUSTOR N-11 DIFF. SCREEN FULL DILUTION AIR
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION =
AT THE MIKE
LEFT SIDE
N-11-710
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

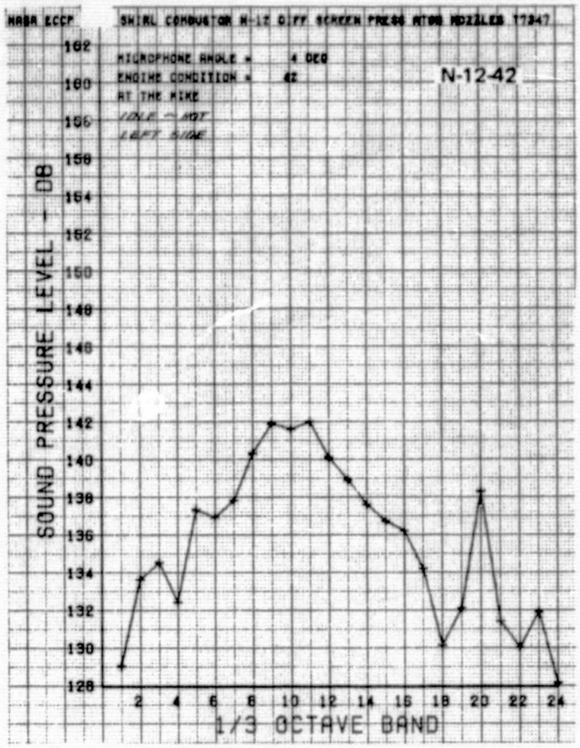

NASA ECCP
SWIRL COMBUSTOR N-11 DIFF. SCREEN FULL DILUTION AIR T7348
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 58
AT THE MIKE
LEFT SIDE
N-11-58
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

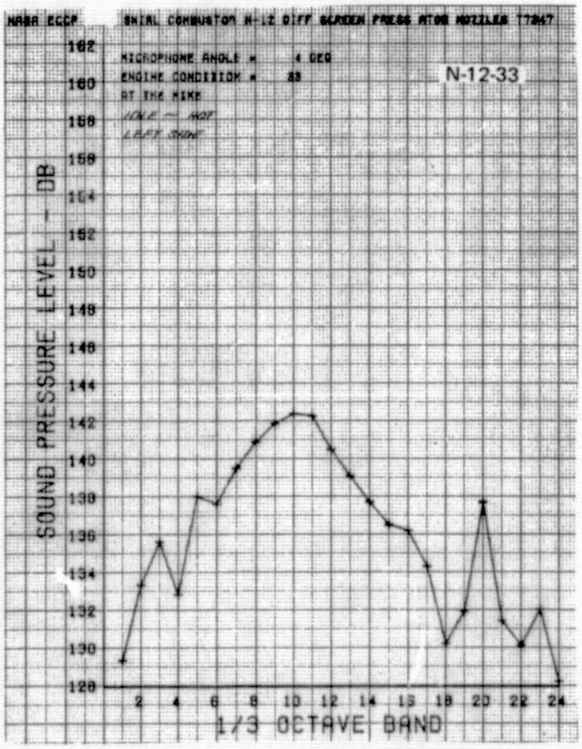

NASA ECCP
SWIRL COMBUSTOR N-11 DIFF. SCREEN FULL DILUTION AIR T7348
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION =
AT THE MIKE
LEFT SIDE
N-11-88
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

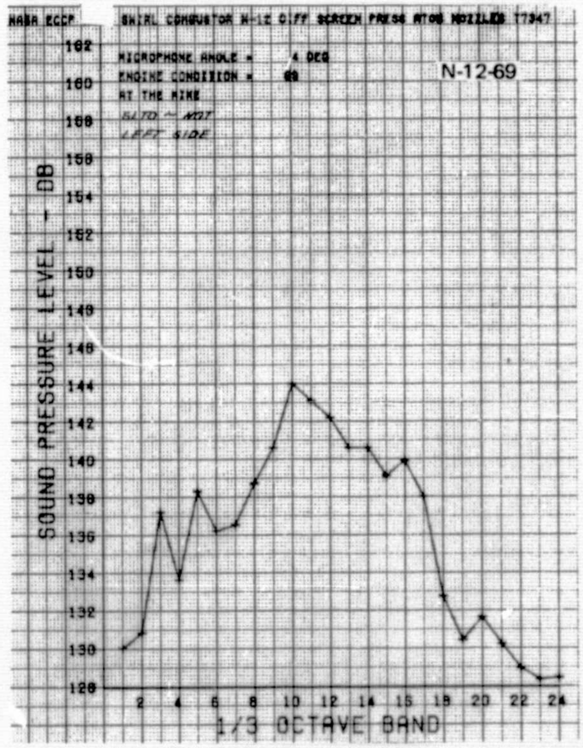

NASA ECCP NASA
COMBUSTOR N-11 DIFF. SCREEN FULL DILUTION AIR T7348
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 89
AT THE MIKE
SLTO - COLD
LEFT SIDE
N-11-89
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

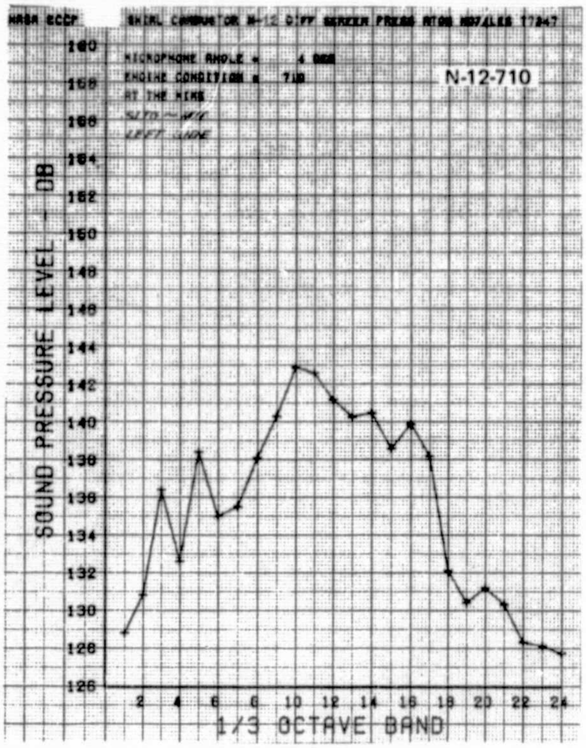

NASA ECCP
SWIRL COMBUSTOR N-12 DIFF SCREEN PRESS ATOM NOZZLES T7347
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 1
AT THE MIKE
IDLE - COLD
LEFT SIDE
N-12-1
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

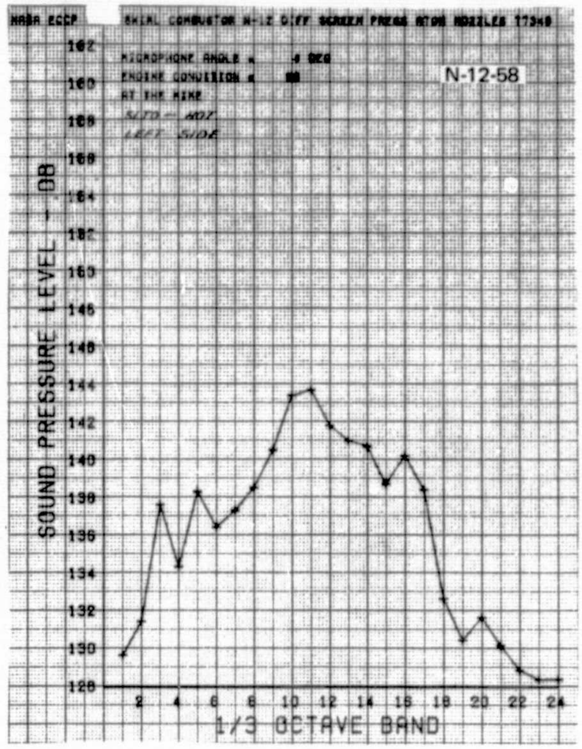

NASA ECCP
SWIRL COMBUSTOR N-12 DIFF SCREEN PRESS ATOS NOZZLES T7347
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 21
AT THE MIKE
IDLE ~ HOT
LEFT SIDE
N-12-21
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

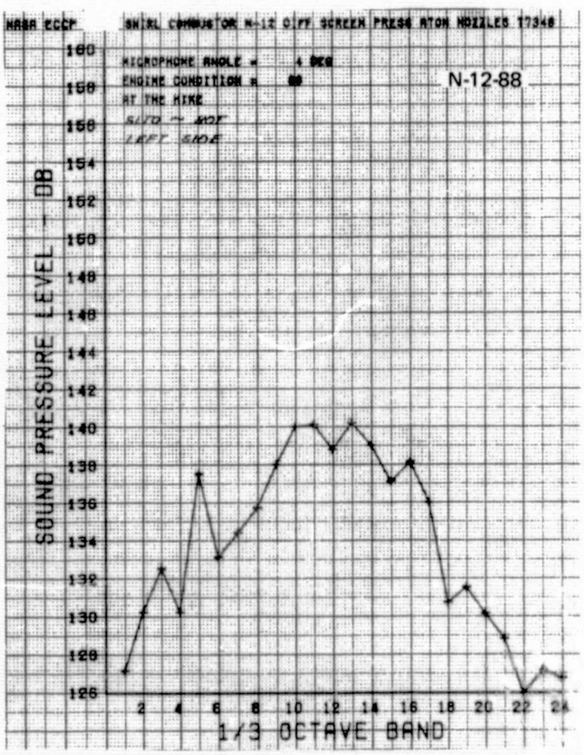

NASA ECCP
SWIRL COMBUSTOR N-12 DIFF SCREEN PRESS ATOS NOZZLES T7347
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 42
AT THE MIKE
IDLE ~ HOT
LEFT SIDE
N-12-42
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

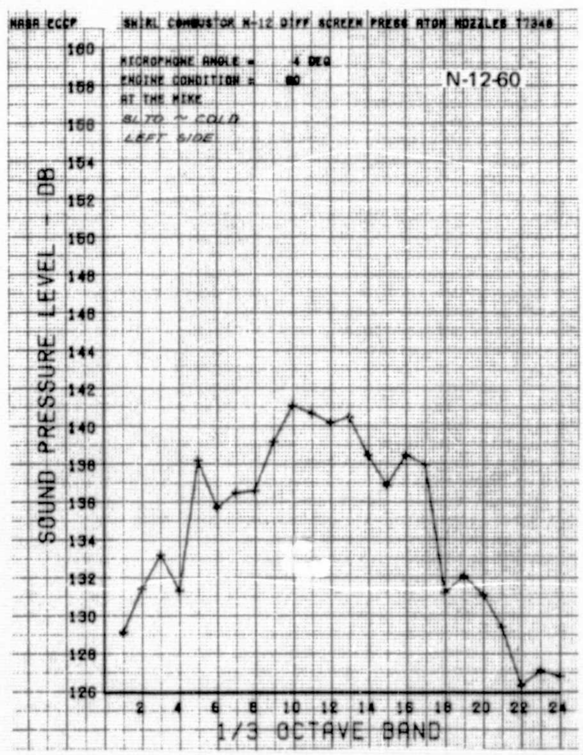

NASA ECCP
SWIRL COMBUSTOR N-12 DIFF SCREEN PRESS ATOS NOZZLES T7347
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 33
AT THE MIKE
IDLE ~ HOT
LEFT SIDE
N-12-33
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

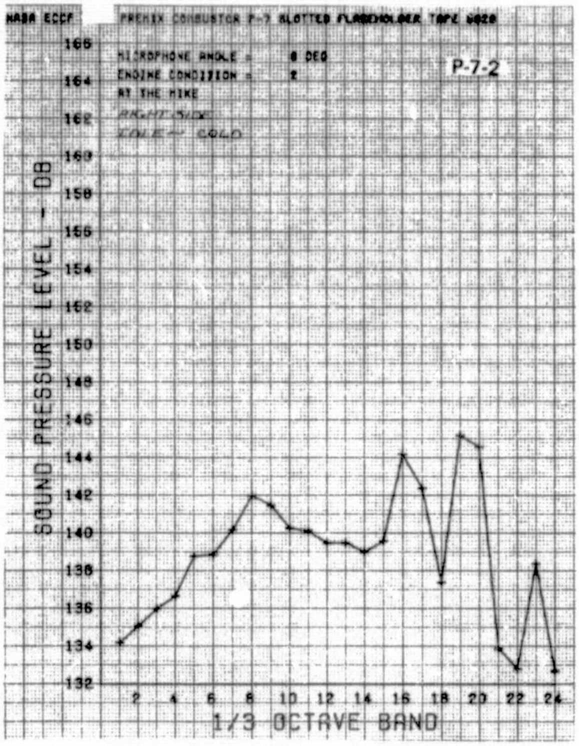

NASA ECCP
SWIRL COMBUSTOR N-12 DIFF SCREEN PRESS ATOS NOZZLES T7347
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 69
AT THE MIKE
SLTO ~ HOT
LEFT SIDE
N-12-69
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

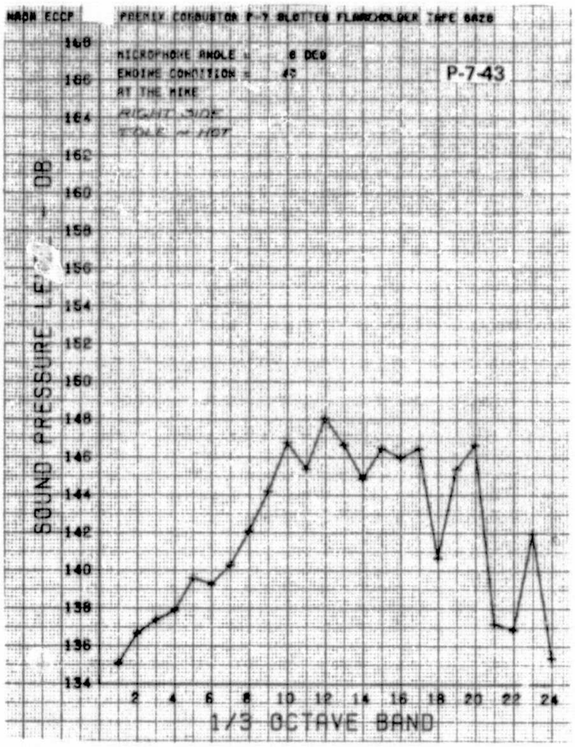

NASA ECCP
SWIRL COMBUSTOR N-12 DIFF SCREEN PRESS ATOM NOZZLES T7347
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 710
AT THE MIKE
LEFT SIDE
N-12-710
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

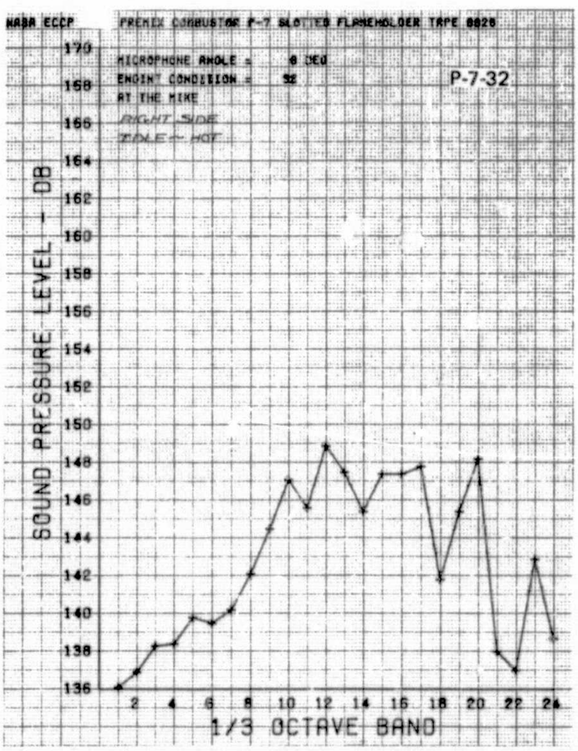

NASA ECCP
SWIRL COMBUSTOR N-12 DIFF SCREEN PRESS ATOM NOZZLES T7348
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 58
AT THE MIKE
SLTO ~ HOT
LEFT SIDE
N-12-58
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

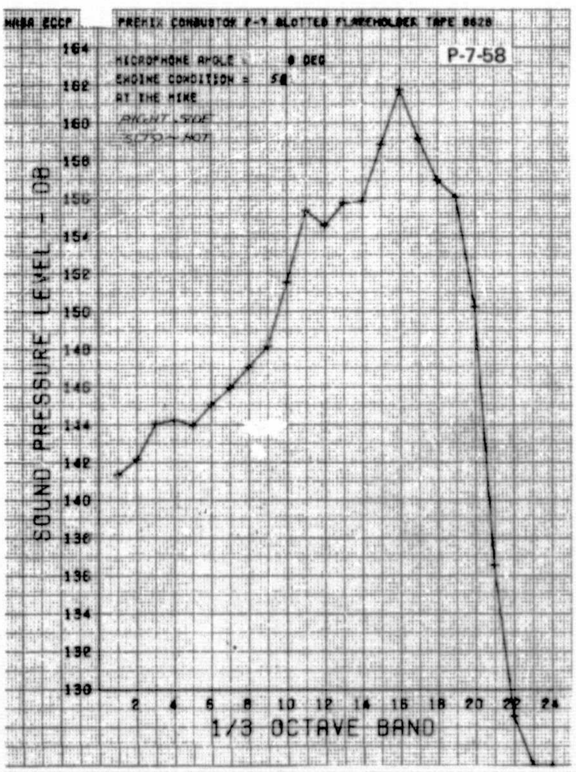

NASA ECCP
SWIRL COMBUSTOR N-12 DIFF SCREEN PRESS ATOM NOZZLES T7348
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 88
AT THE MIKE
SLTO ~ HOT
LEFT SIDE
N-12-88
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

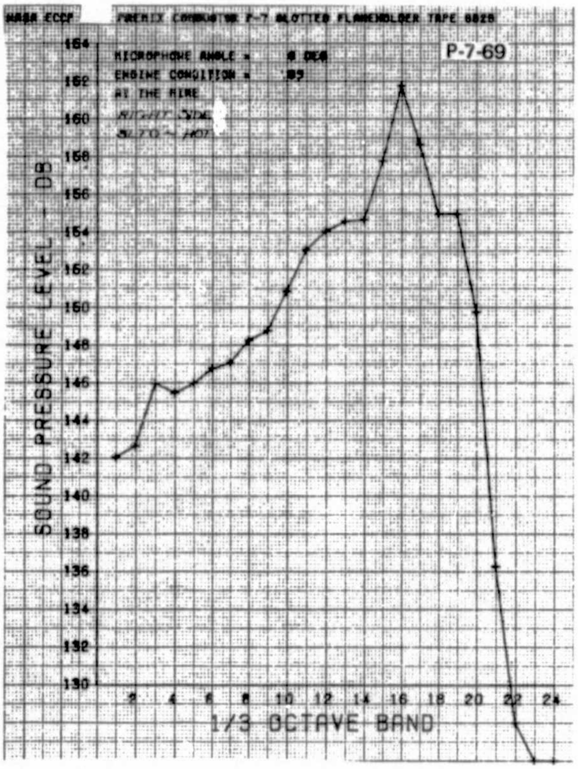

NASA ECCP
SWIRL COMBUSTOR N-12 DIFF SCREEN PRESS ATOM NOZZLES T7348
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 60
AT THE MIKE
SLTO ~ COLD
LEFT SIDE
N-12-60
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

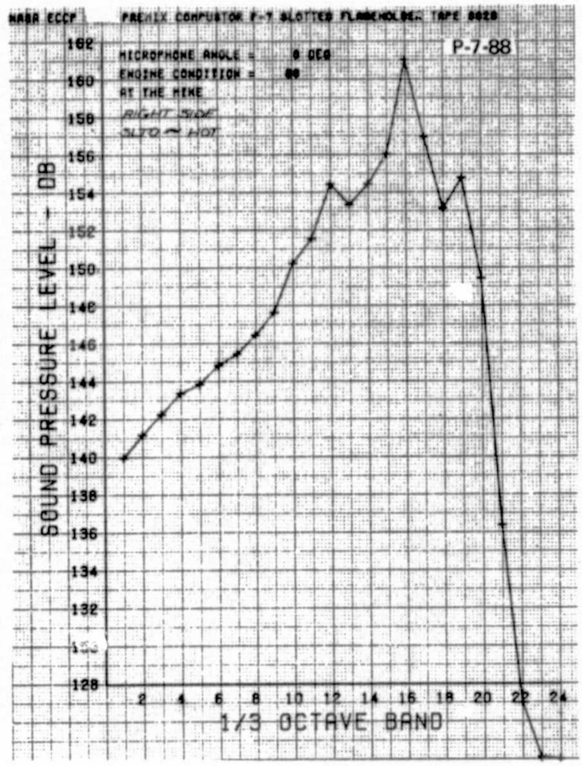

NASA ECCP
PREMIX COMBUSTOR P-7 SLOTTED FLAMEHOLDER TAPE 6628
MICROPHONE ANGLE = 0 DEG
ENGINE CONDITION = 2
AT THE MIKE
RIGHT SIDE
IDLE ~ COLD
P-7-2
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

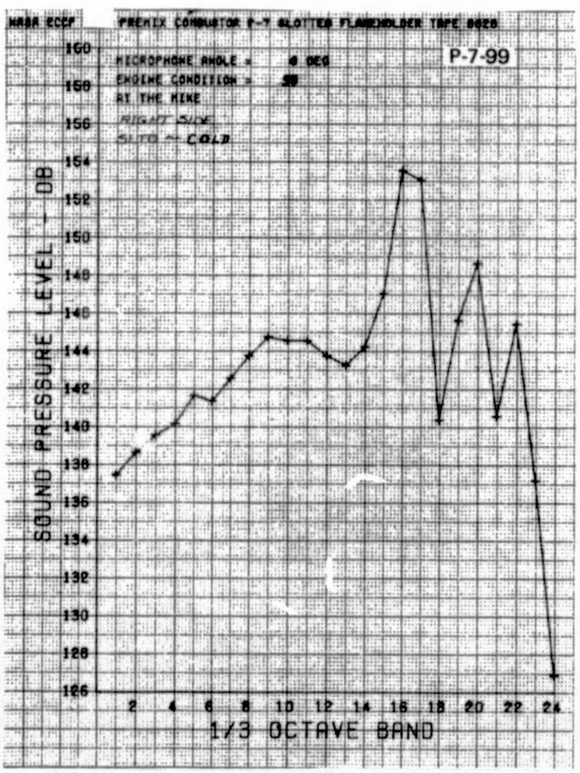

NASA ECCP
PREMIX COMBUSTOR P-7 SLOTTED FLAMEHOLDER TAPE 6628
MICROPHONE ANGLE = 0 DEG
ENGINE CONDITION = 43
AT THE MIKE
RIGHT SIDE
IDLE ~ HOT
P-7-43
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

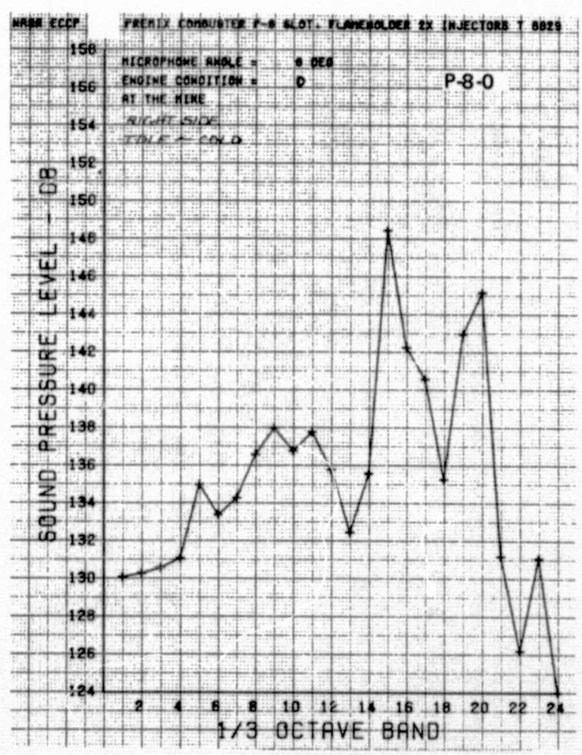

NASA ECCP
PREMIX COMBUSTOR P-7 SLOTTED FLAMEHOLDER TAPE 6628
MICROPHONE ANGLE = 0 DEG
ENGINE CONDITION = 32
AT THE MIKE
RIGHT SIDE
IDLE ~ HOT
P-7-32
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND


NASA ECCP
PREMIX COMBUSTOR P-7 SLOTTED FLAMEHOLDER TAPE 6628
MICROPHONE ANGLE = 0 DEG
ENGINE CONDITION = 58
AT THE MIKE
RIGHT SIDE
S/TO ~ HOT
P-7-58
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

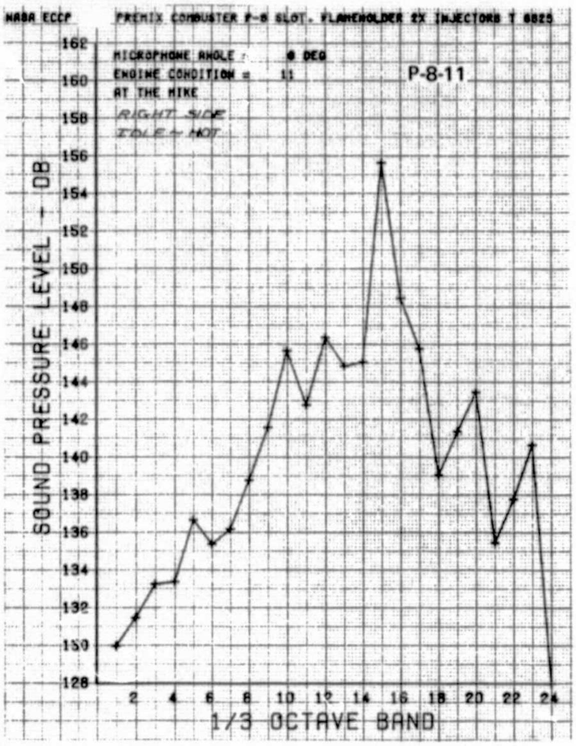

NASA ECCP
PREMIX COMBUSTOR P-7 SLOTTED FLAMEHOLDER TAPE 8828
P-7-69
MICROPHONE ANGLE = 0 DEG
ENGINE CONDITION =
AT THE MIKE
RIGHT SIDE
SLTO ~ HOT
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

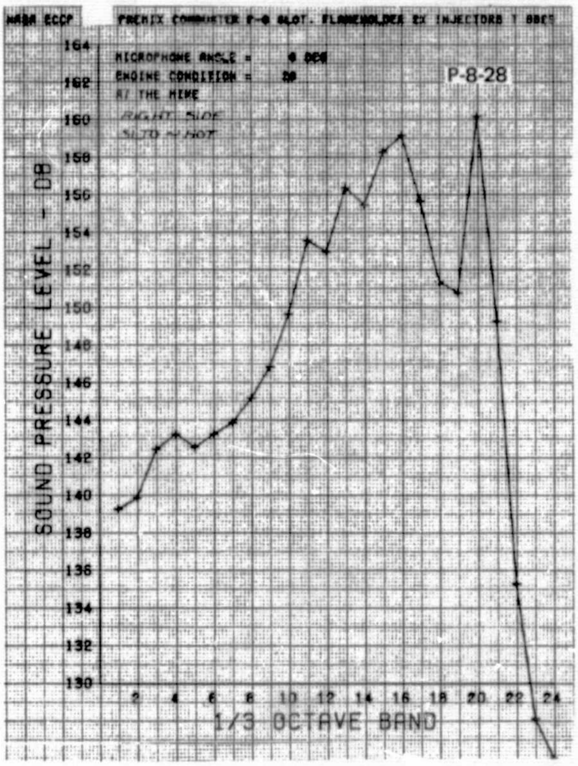

NASA ECCP
PREMIX COMBUSTOR P-7 SLOTTED FLAMEHOLDER TAPE 8828
P-7-88
MICROPHONE ANGLE = 0 DEG
ENGINE CONDITION =
AT THE MIKE
RIGHT SIDE
SLTO ~ HOT
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

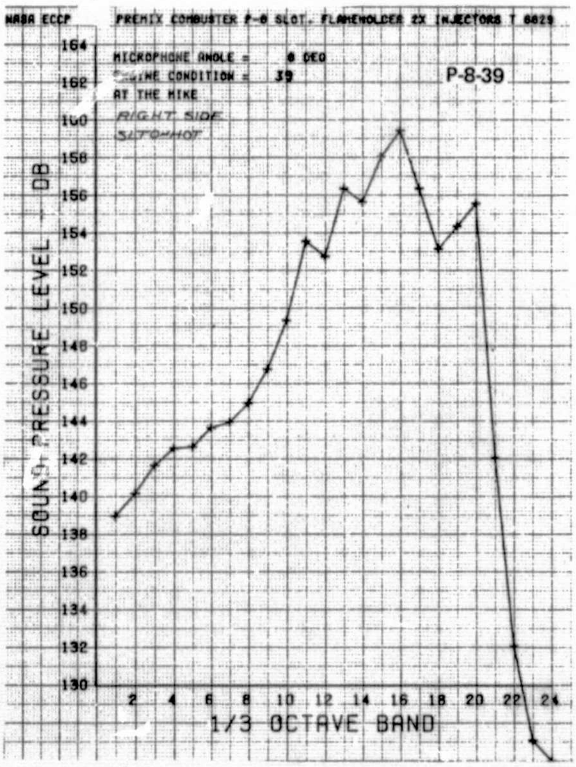

NASA ECCP
PREMIX COMBUSTOR P-7 SLOTTED FLAMEHOLDER TAPE 8828
P-7-99
MICROPHONE ANGLE = 0 DEG
ENGINE CONDITION =
AT THE MIKE
RIGHT SIDE
SLTO ~ COLD
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

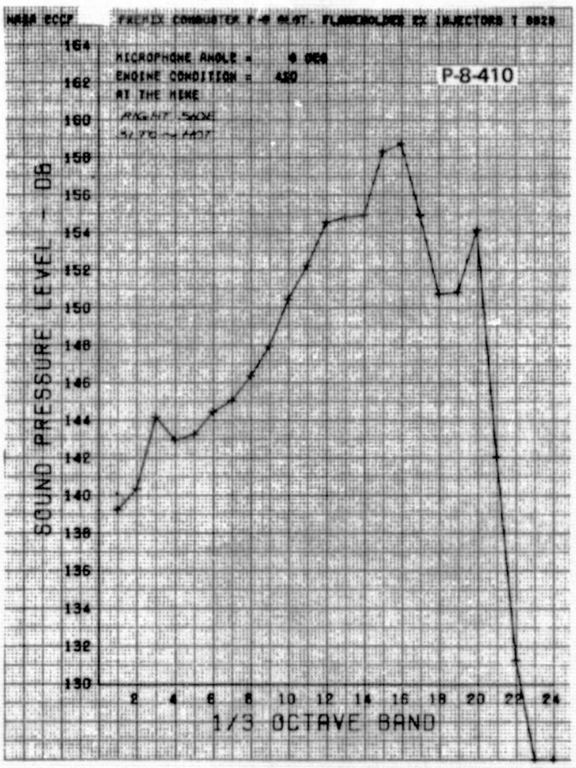

NASA ECCP
PREMIX COMBUSTER P-8 SLOT. FLAMEHOLDER 2X INJECTORS T 8829
MICROPHONE ANGLE = 0 DEG
ENGINE CONDITION = 0
AT THE MIKE
P-8-0
RIGHT SIDE
IDLE ~ COLD
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

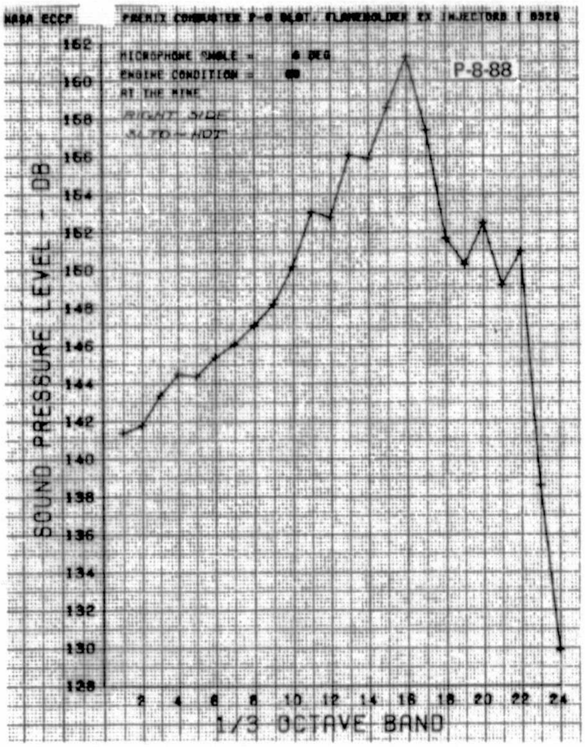
C.2

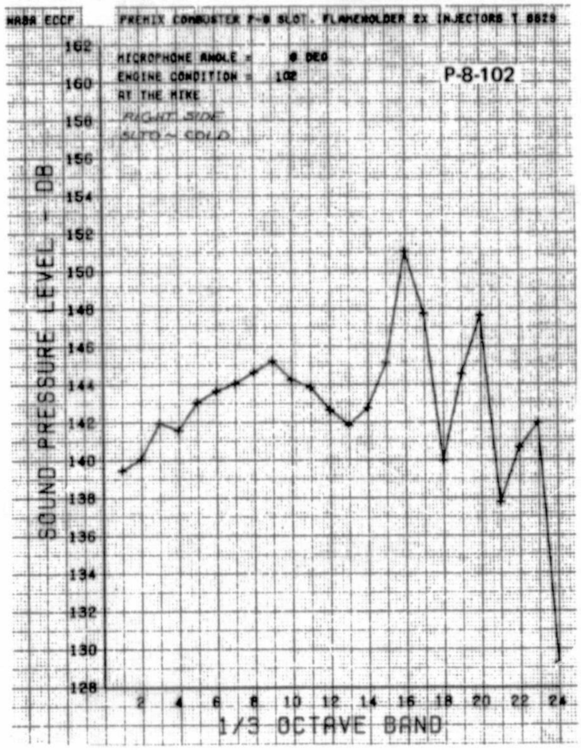

NASA ECCP
PREMIX COMBUSTER P-8 SLOT. FLAMEHOLDER 2X INJECTORS T 8825
MICROPHONE ANGLE = 0 DEG
ENGINE CONDITION = 11
AT THE MIKE
RIGHT SIDE
IDLE ~ HOT
P-8-11
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

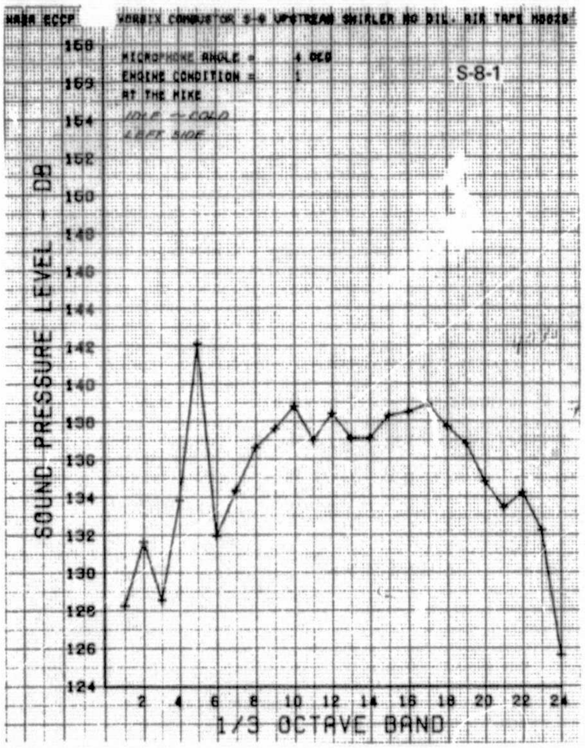

NASA ECCP
PREMIX COMBUSTER P-8 SLOT. FLAMEHOLDER 2X INJECTORS T 8825
MICROPHONE ANGLE = 0 DEG
ENGINE CONDITION = 28
AT THE MIKE
RIGHT SIDE
SLTO ~ HOT
P-8-28
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

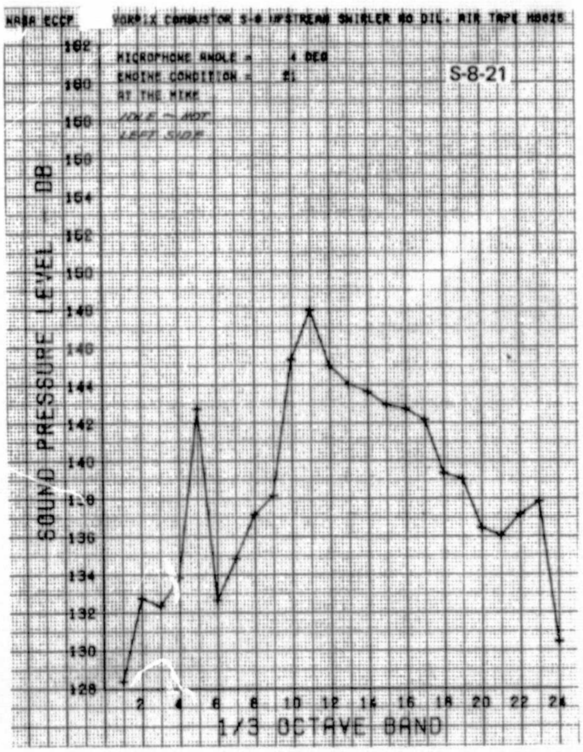

NASA ECCP
PREMIX COMBUSTER P-8 SLOT. FLAMEHOLDER 2X INJECTORS T 8825
MICROPHONE ANGLE = 0 DEG
ENGINE CONDITION = 39
AT THE MIKE
RIGHT SIDE
SLTO~HOT
P-8-39
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

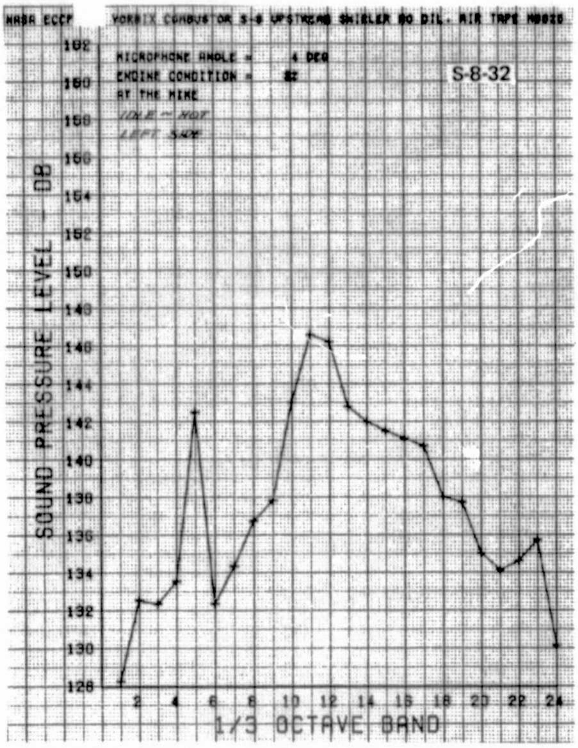

NASA ECCP
PREMIX COMBUSTER P-8 SLOT. FLAMEHOLDER 2X INJECTORS T 8825
MICROPHONE ANGLE = 0 DEG
ENGINE CONDITION = 410
AT THE MIKE
RIGHT SIDE
SLTO ~ HOT
P-8-410
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

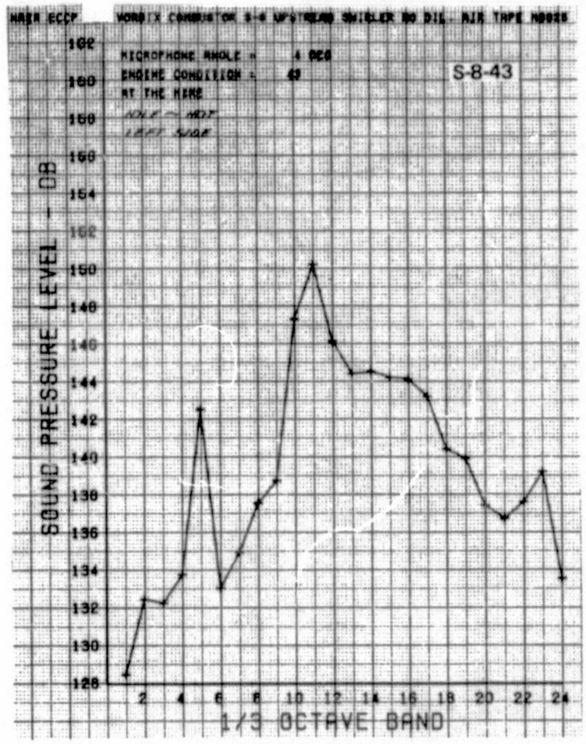

NASA ECCP
PREMIX COMBUSTOR P-8 SLOT. FLAMEHOLDER 2X INJECTORS
MICROPHONE ANGLE =
ENGINE CONDITION =
AT THE MIKE
RIGHT SIDE
SLTO ~ HOT
P-8-88
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

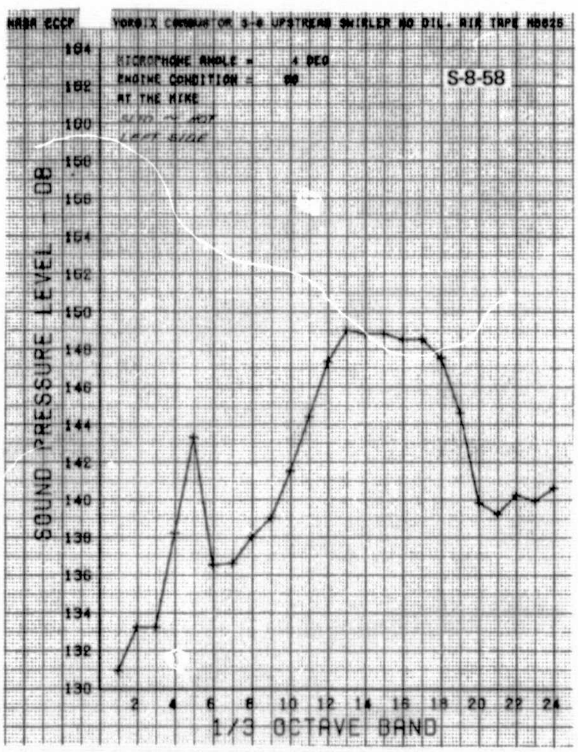

NASA ECCP
PREMIX COMBUSTOR P-8 SLOT. FLAMEHOLDER 2X INJECTORS
MICROPHONE ANGLE =
ENGINE CONDITION = 102
AT THE MIKE
RIGHT SIDE
SLTO ~ COLD
P-8-102
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

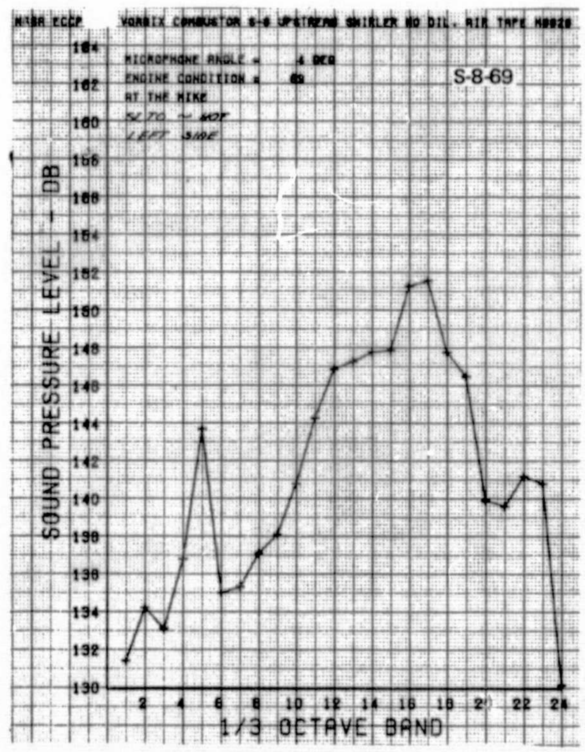

NASA ECCP
VORBIX COMBUSTOR S-8 UPSTREAM SWIRLER NO DIL. AIR TAPE
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 1
AT THE MIKE
IDLE ~ COLD
LEFT SIDE
S-8-1
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

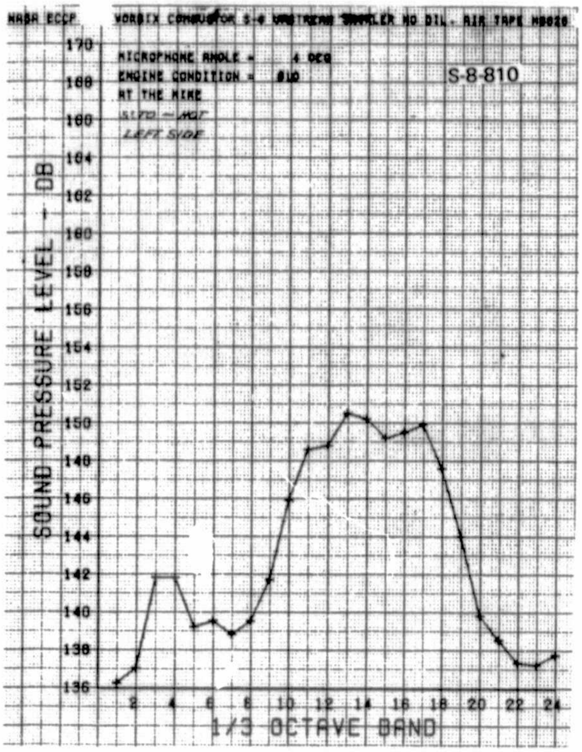

NASA ECCP
VORBIX COMBUSTOR S-8 UPSTREAM SWIRLER NO DIL. AIR TAPE
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 21
AT THE MIKE
IDLE ~ HOT
LEFT SIDE
S-8-21
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND


NASA ECCP
VORBIX COMBUSTOR S-8 UPSTREAM SWIRLER NO DIL. AIR
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION =
AT THE MIKE
IDLE ~ HOT
LEFT SIDE
S-8-32
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

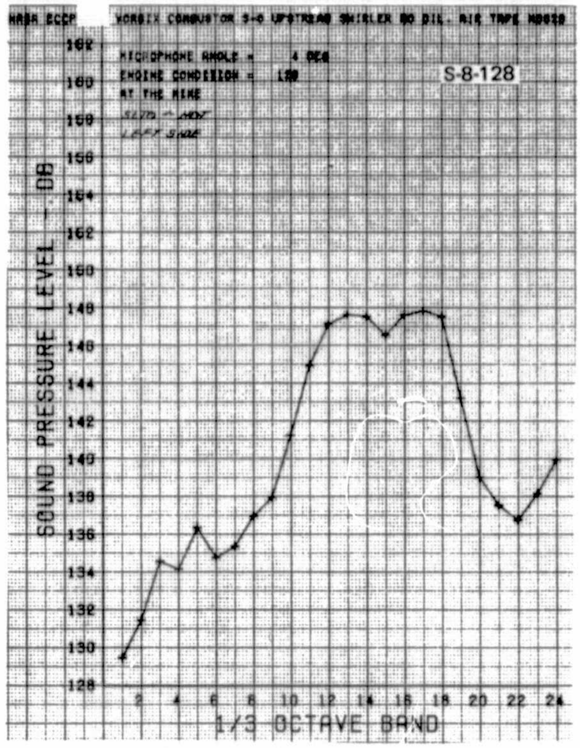

NASA ECCP
VORBIX COMBUSTOR S-8 UPSTREAM SWIRLER NO DIL. AIR
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION =
AT THE MIKE
IDLE ~ HOT
LEFT SIDE
S-8-43
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND


NASA ECCP
VORBIX COMBUSTOR S-8 UPSTREAM SWIRLER NO DIL. AIR
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION =
AT THE MIKE
SLTO ~ HOT
LEFT SIDE
S-8-58
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

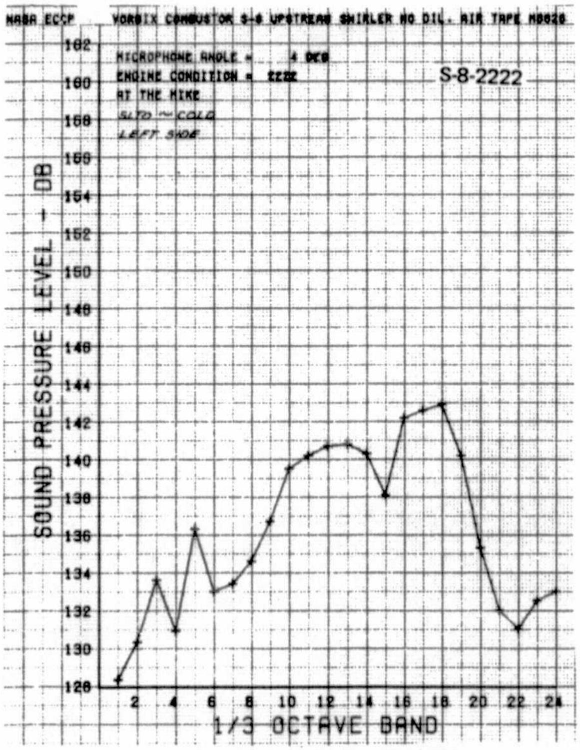

NASA ECCP
VORBIX COMBUSTOR S-8 UPSTREAM SWIRLER NO DIL. AIR
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION =
AT THE MIKE
SLTO ~ HOT
LEFT SIDE
S-8-69
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND



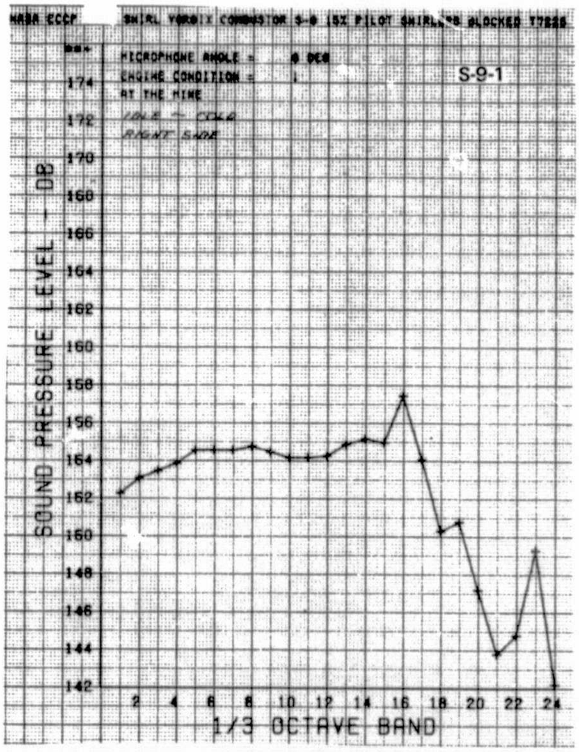
NASA ECCP
VORBIX COMBUSTOR S-8 UPSTREAM SWIRLER NO DIL. AIR TAPE
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 810
AT THE MIKE
SLTO ~ HOT
LEFT SIDE
S-8-810
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND



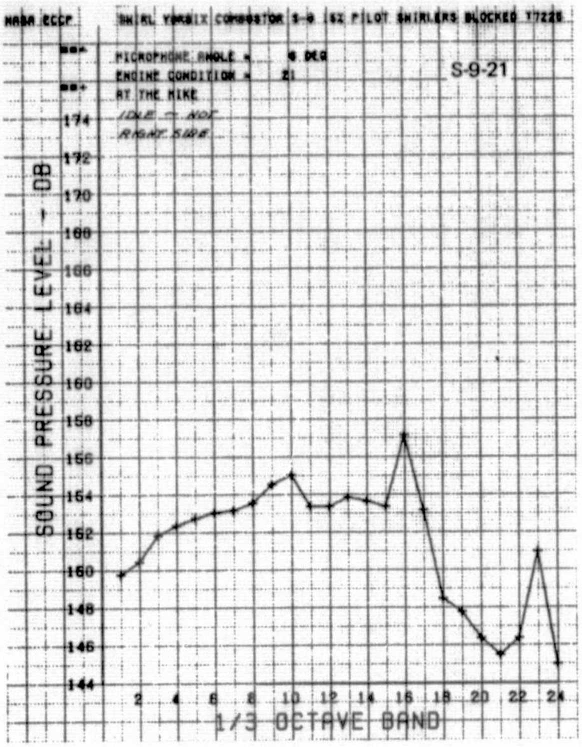
NASA ECCP
VORBIX COMBUSTOR S-8 UPSTREAM SWIRLER NO DIL. AIR TAPE
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 128
AT THE MIKE
SLTO ~ HOT
LEFT SIDE
S-8-128
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

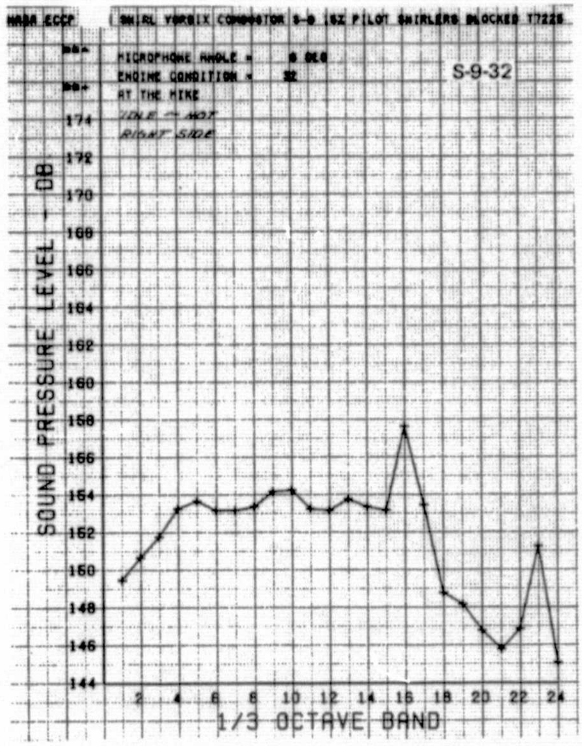


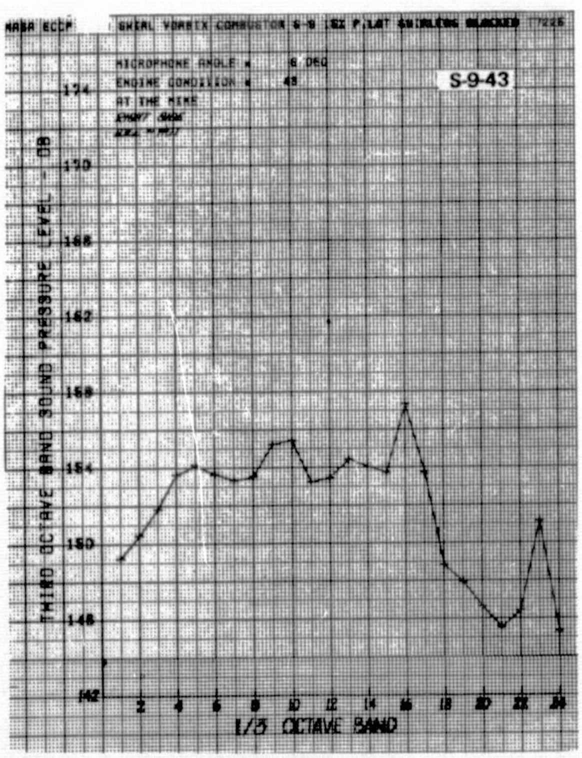
NASA ECCP
VORBIX COMBUSTOR S-8 UPSTREAM SWIRLER NO DIL. AIR TAPE
MICROPHONE ANGLE = 4 DEG
ENGINE CONDITION = 2222
AT THE MIKE
SLTO ~ COLD
LEFT SIDE
S-8-2222
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

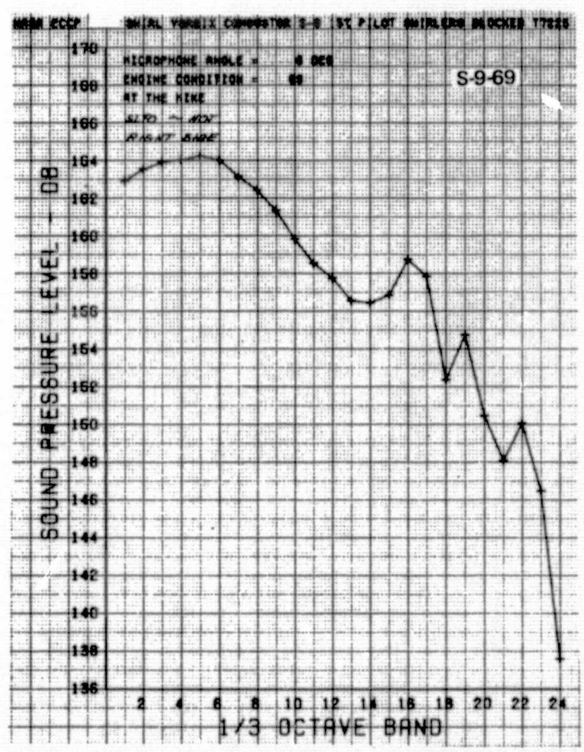


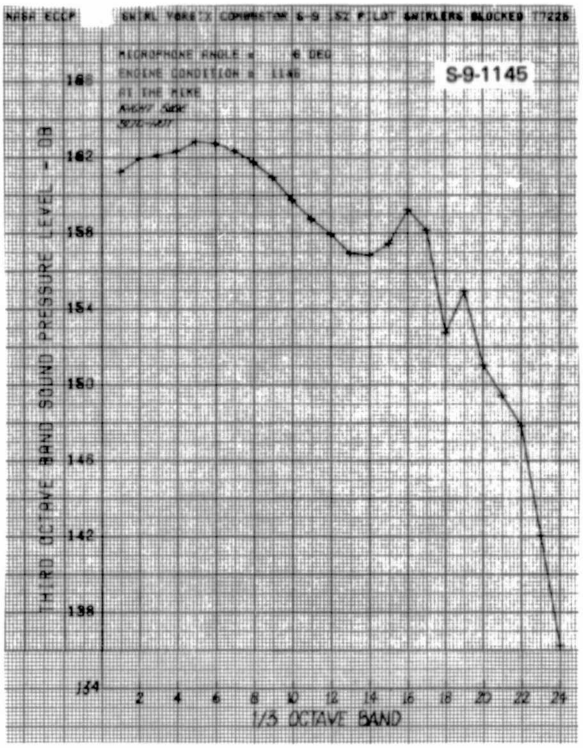
NASA ECCP
SWIRL VORBIX COMBUSTOR S-9 15% PILOT SWIRLERS BLOCKED
MICROPHONE ANGLE
ENGINE CONDITION = 1
AT THE MIKE
IDLE ~ COLD
RIGHT SIDE
S-9-1
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

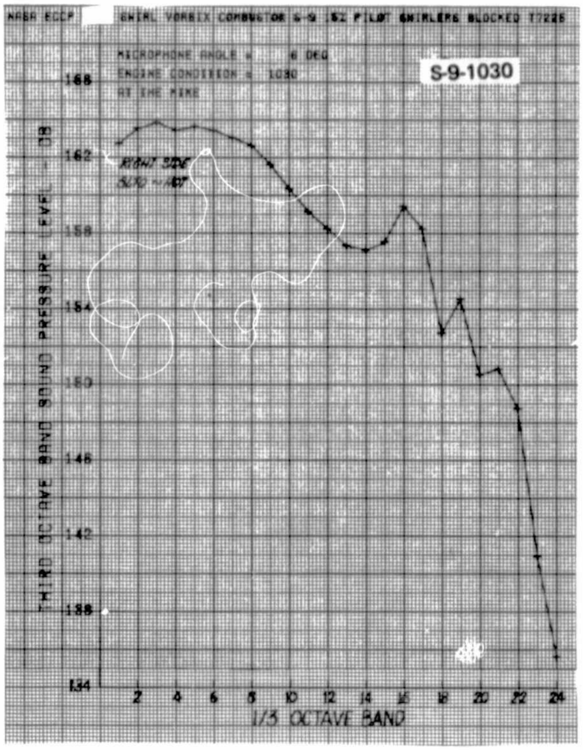

NASA ECCP
MICROPHONE ANGLE =
ENGINE CONDITION = 21
AT THE MIKE
S-9-21
SOUND PRESSURE LEVEL – DB
1/3 OCTAVE BAND

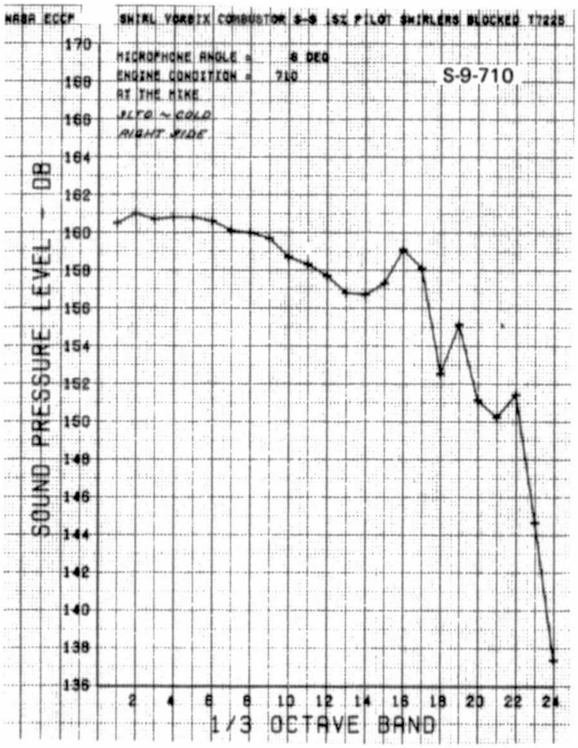

NASA ECCP
MICROPHONE ANGLE =
ENGINE CONDITION = 32
AT THE MIKE
S-9-32
SOUND PRESSURE LEVEL – DB
1/3 OCTAVE BAND

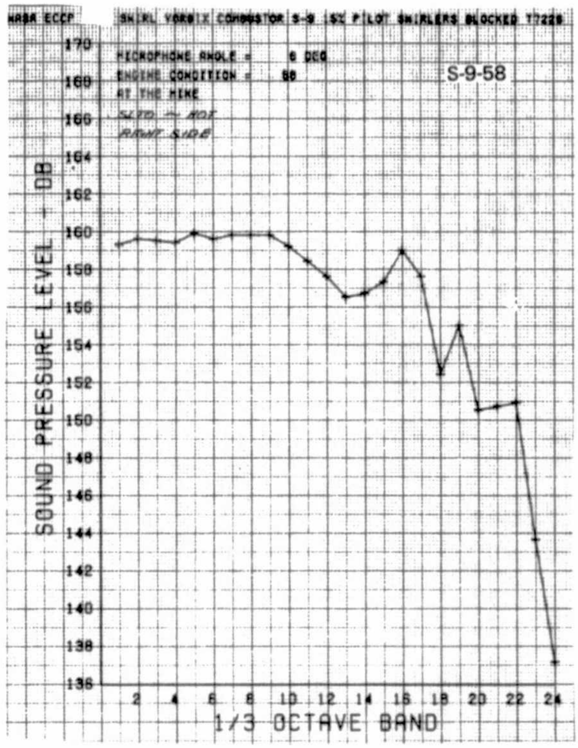

NASA ECCP
MICROPHONE ANGLE =
ENGINE CONDITION =
AT THE MIKE
S-9-43
THIRD OCTAVE BAND SOUND PRESSURE LEVEL – DB
1/3 OCTAVE BAND

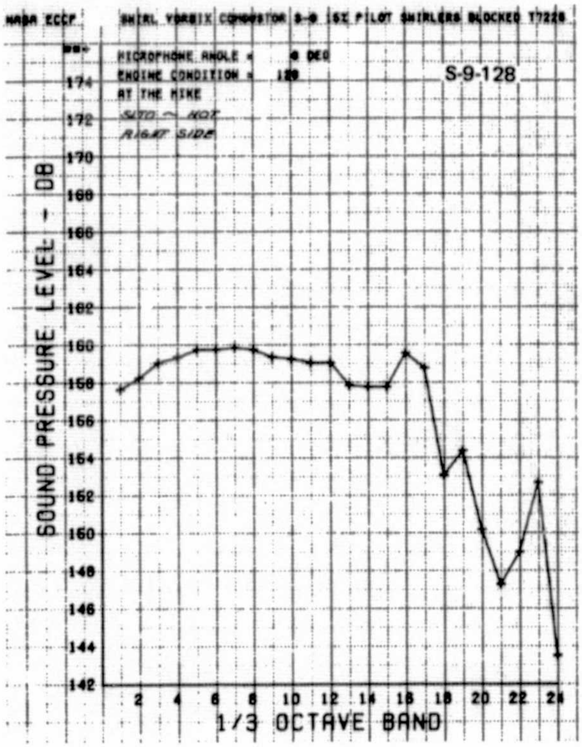

NASA ECCP
MICROPHONE ANGLE =
ENGINE CONDITION =
AT THE MIKE
S-9-69
SOUND PRESSURE LEVEL – DB
1/3 OCTAVE BAND

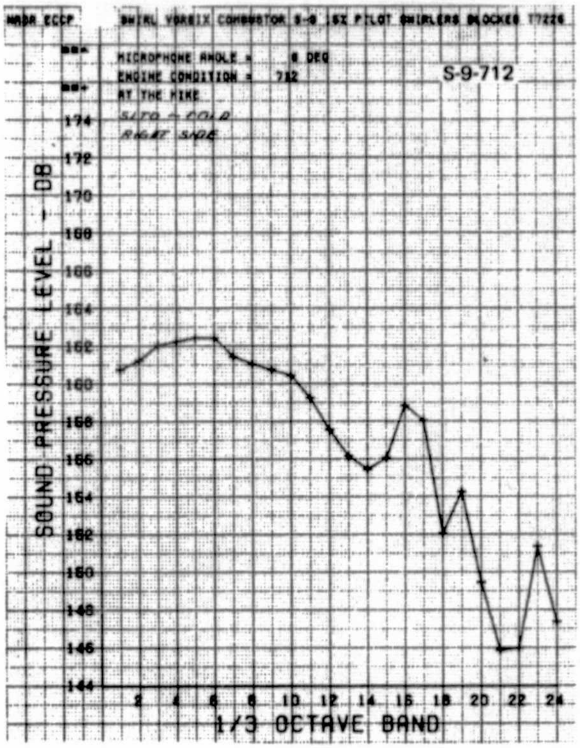

S-9-1145
1/3 OCTAVE BAND
THIRD OCTAVE BAND SOUND PRESSURE LEVEL - DB


S-9-1030
1/3 OCTAVE BAND
THIRD OCTAVE BAND SOUND PRESSURE LEVEL - DB


S-9-710
MICROPHONE ANGLE = 6 DEG
ENGINE CONDITION = 710
AT THE MIKE
1/3 OCTAVE BAND
SOUND PRESSURE LEVEL - DB

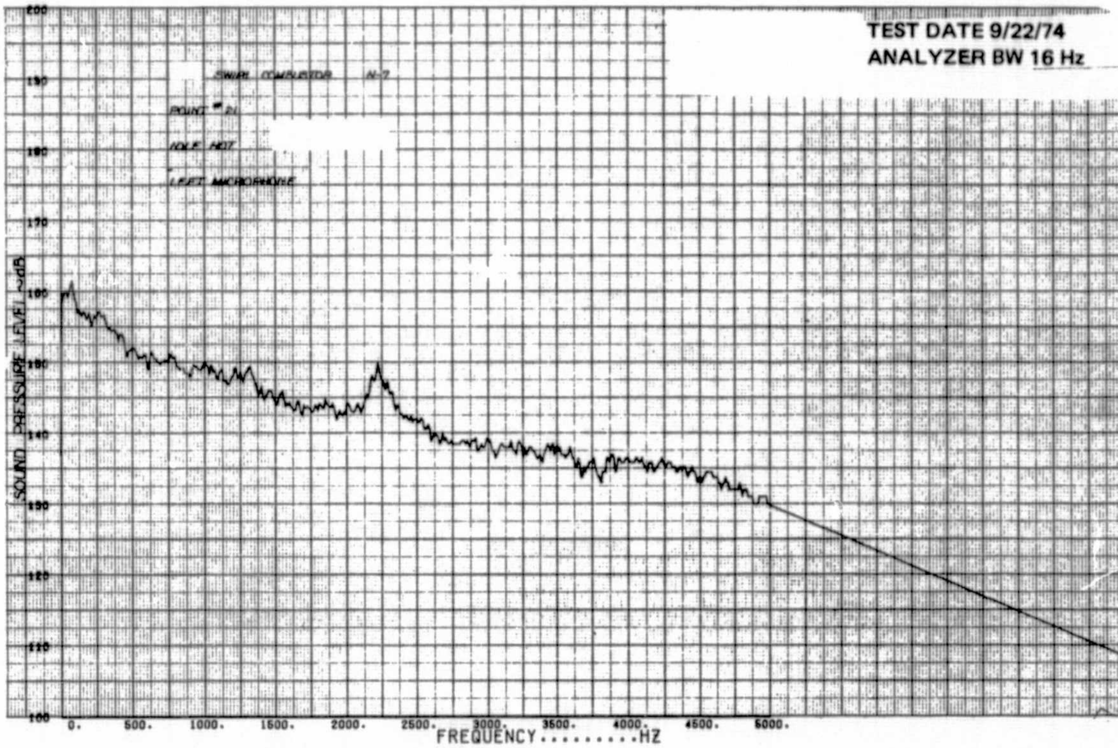

S-9-58
MICROPHONE ANGLE = 6 DEG
AT THE MIKE
1/3 OCTAVE BAND
SOUND PRESSURE LEVEL - DB

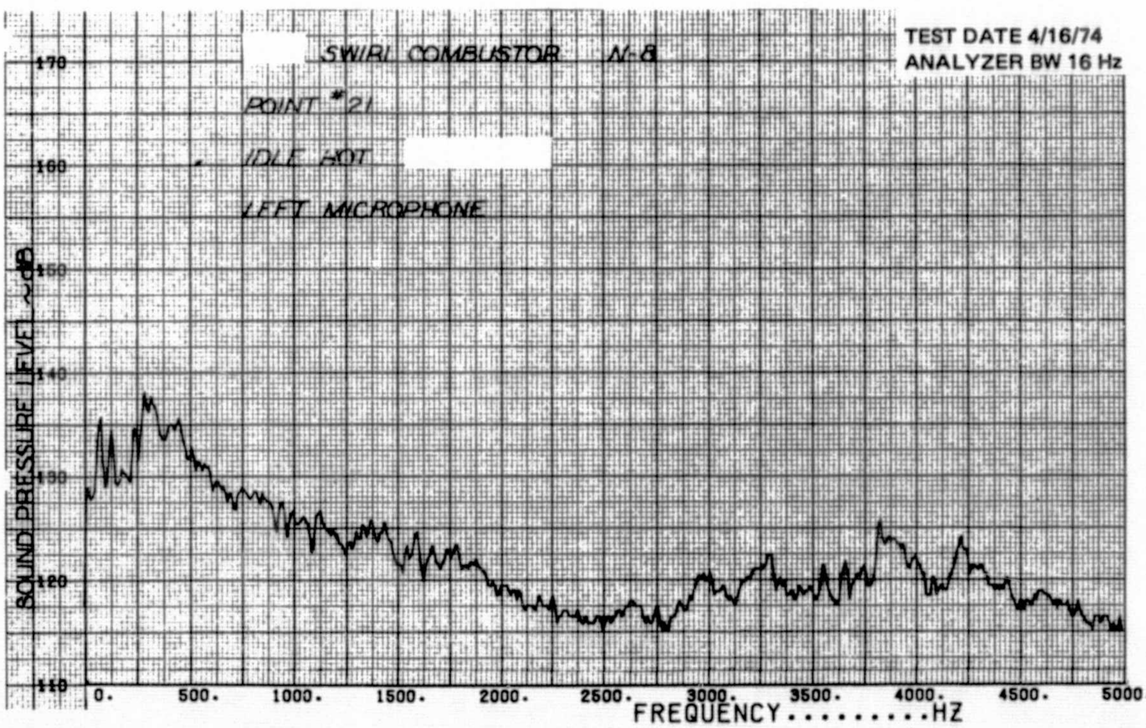

SWIRL VORTEX COMBUSTOR S-9 15% PILOT SWIRLERS BLOCKED
MICROPHONE ANGLE =
ENGINE CONDITION = 128
AT THE MIKE
RIGHT SIDE
S-9-128
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

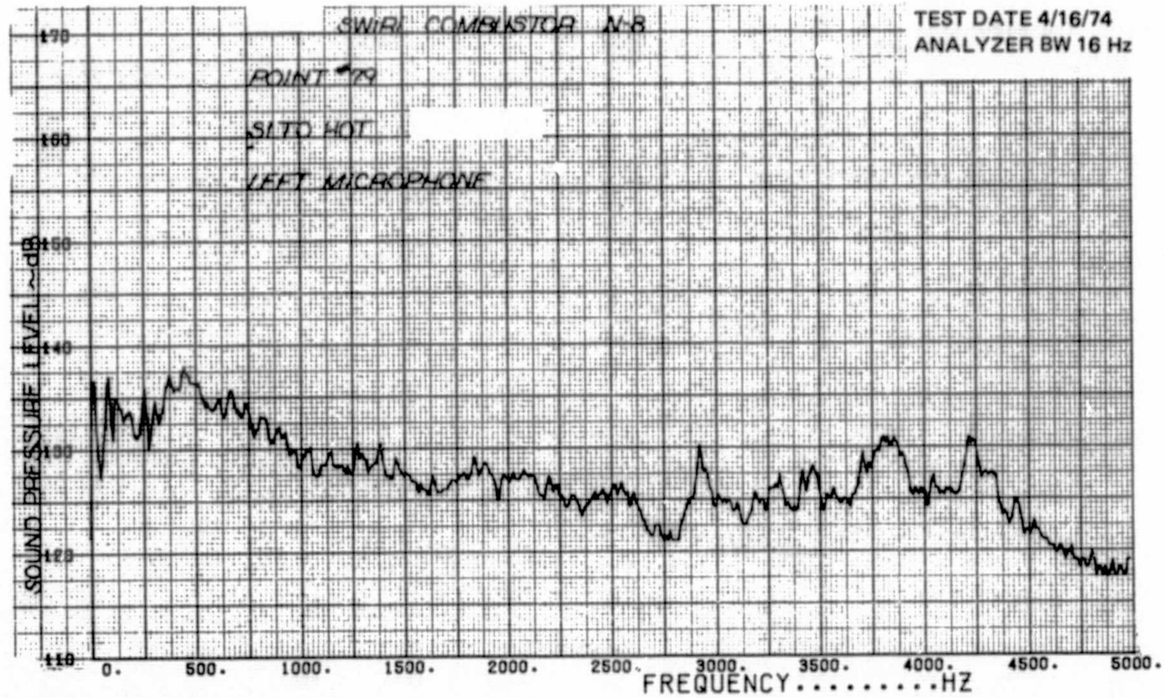

SWIRL VORTEX COMBUSTOR S-9 15% PILOT SWIRLERS BLOCKED
MICROPHONE ANGLE =
ENGINE CONDITION =
AT THE MIKE
RIGHT SIDE
S-9-712
SOUND PRESSURE LEVEL - DB
1/3 OCTAVE BAND

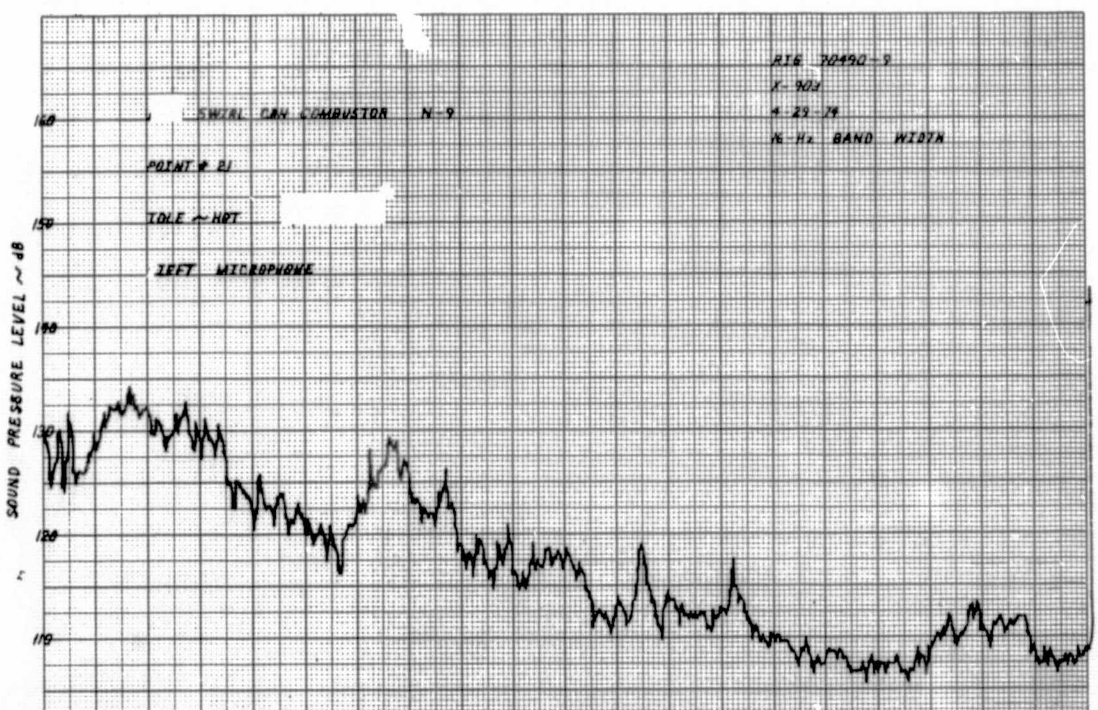
APPENDIX E

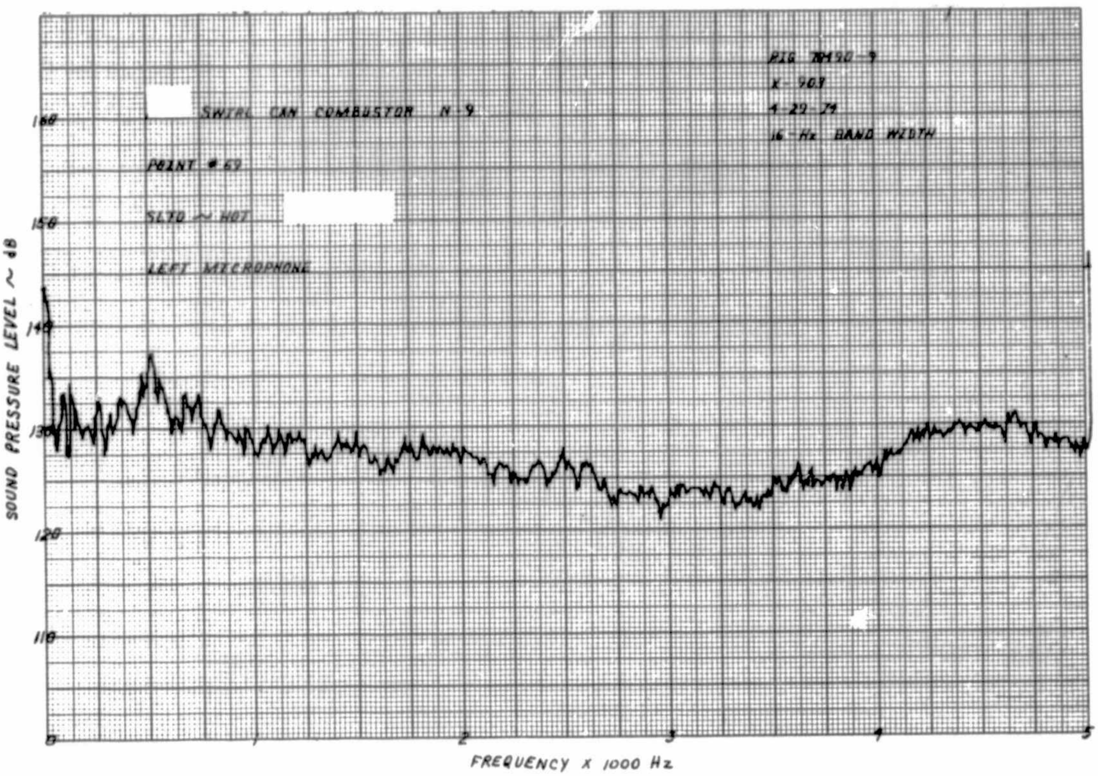
SELECTED NARROW BAND (16 Hz) SPECTRA

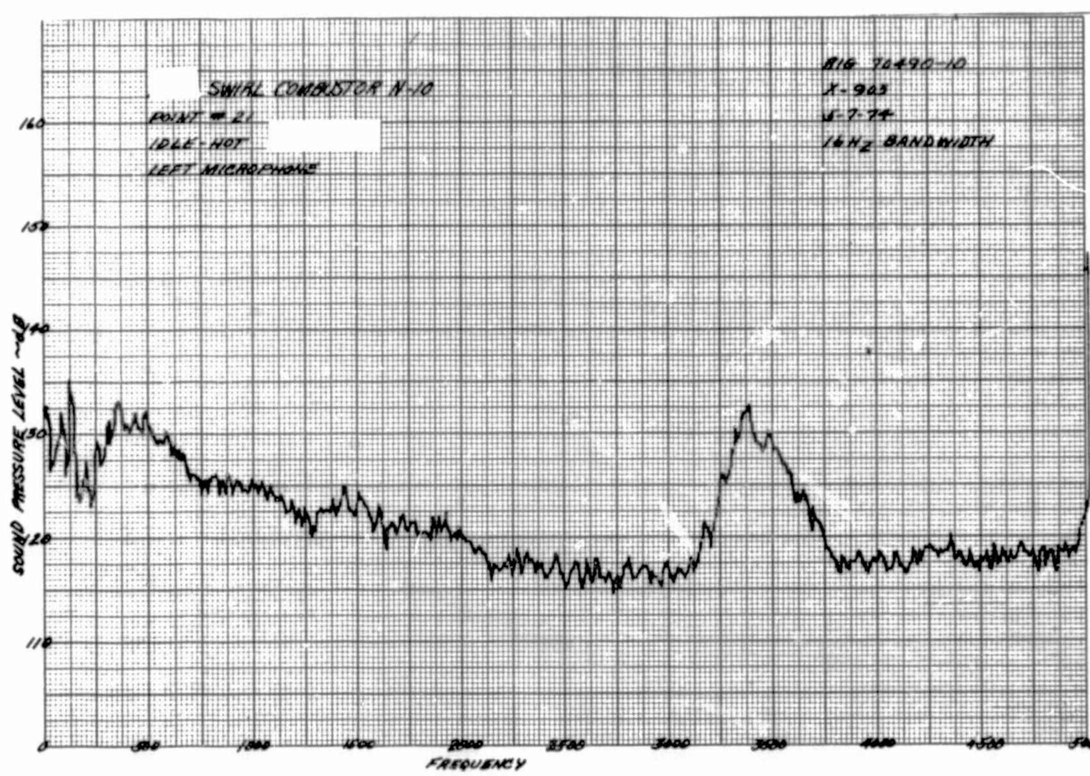

TEST DATE 9/22/74
ANALYZER BW 16 Hz
SWIRL COMBUSTOR N-7
POINT # 21
IDLE HOT
LEFT MICROPHONE
SOUND PRESSURE LEVEL ~dB
200
190
180
170
160
150
140
130
120
110
100
0.
500.
1000.
1500.
2000.
2500.
3000.
3500.
4000.
4500.
5000.
FREQUENCY.........HZ

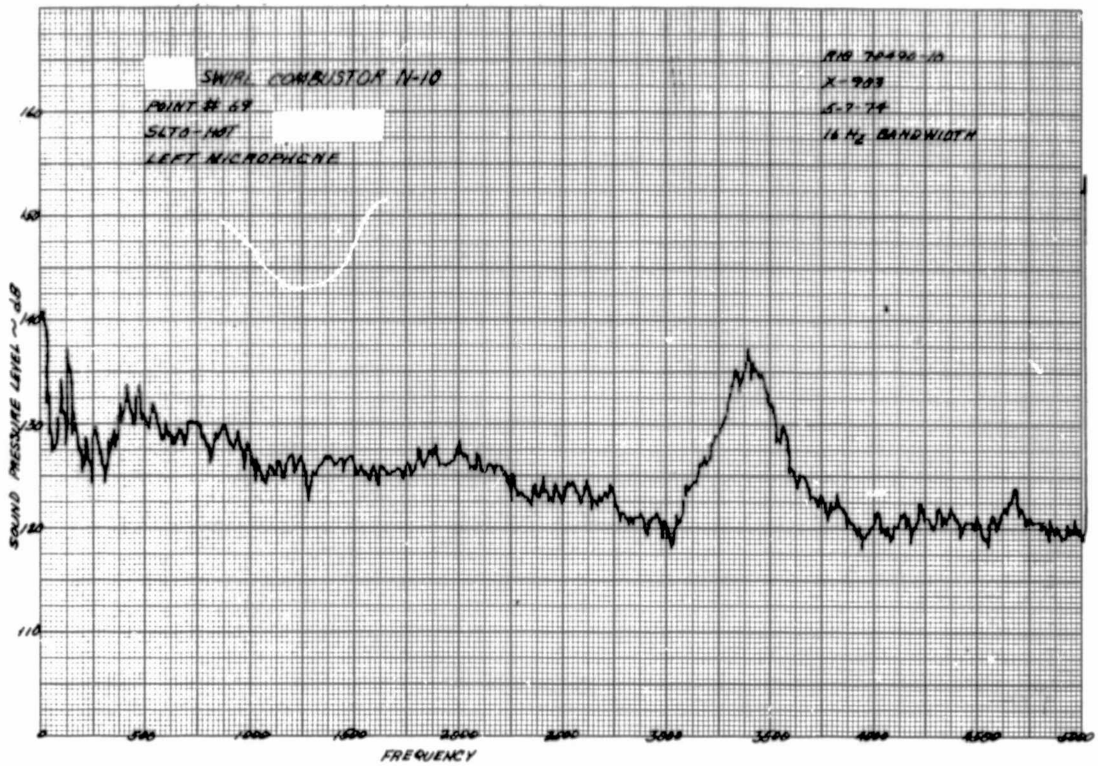

TEST DATE 4/16/74
ANALYZER BW 16 Hz
SWIRL COMBUSTOR N-8
POINT # 21
IDLE HOT
LEFT MICROPHONE
SOUND PRESSURE LEVEL ~dB
170
160
150
140
130
120
110
0.
500.
1000.
1500.
2000.
2500.
3000.
3500.
4000.
4500.
5000.
FREQUENCY.........HZ

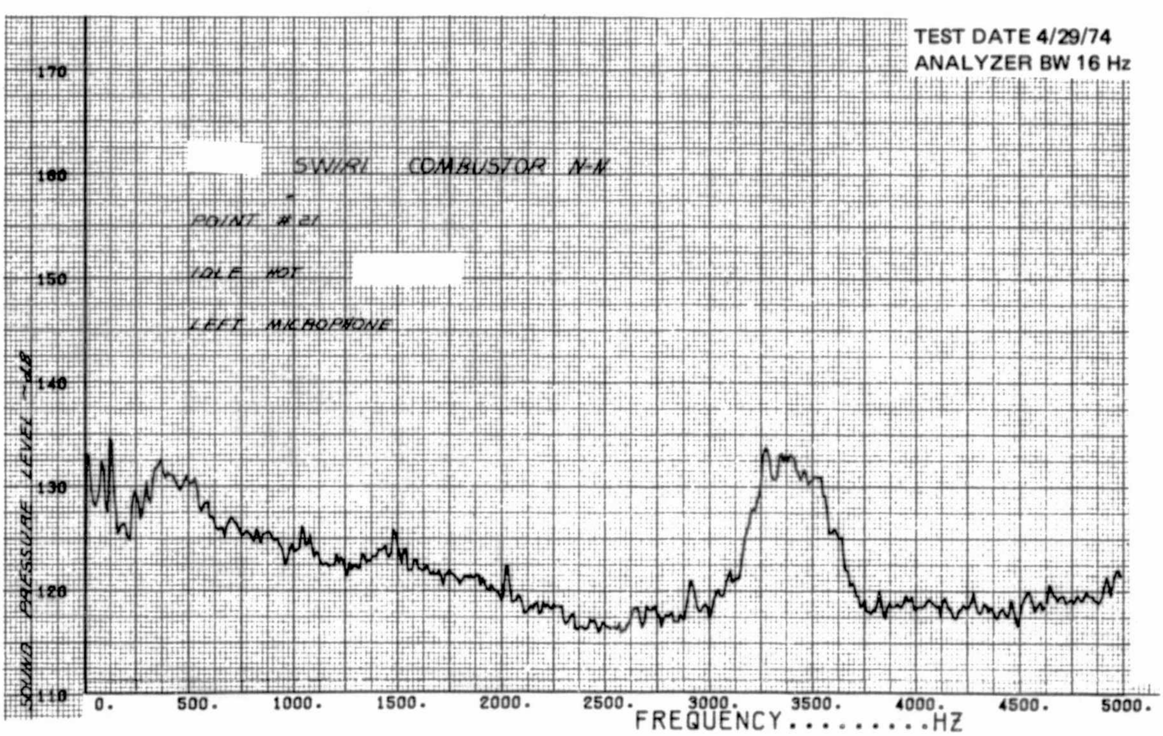

SWIRL COMBUSTOR N-8
TEST DATE 4/16/74
ANALYZER BW 16 Hz
POINT #79
SLTO HOT
LEFT MICROPHONE
SOUND PRESSURE LEVEL ~dB
170
160
150
140
130
120
110
0.
500.
1000.
1500.
2000.
2500.
3000.
3500.
4000.
4500.
5000.
FREQUENCY.........HZ

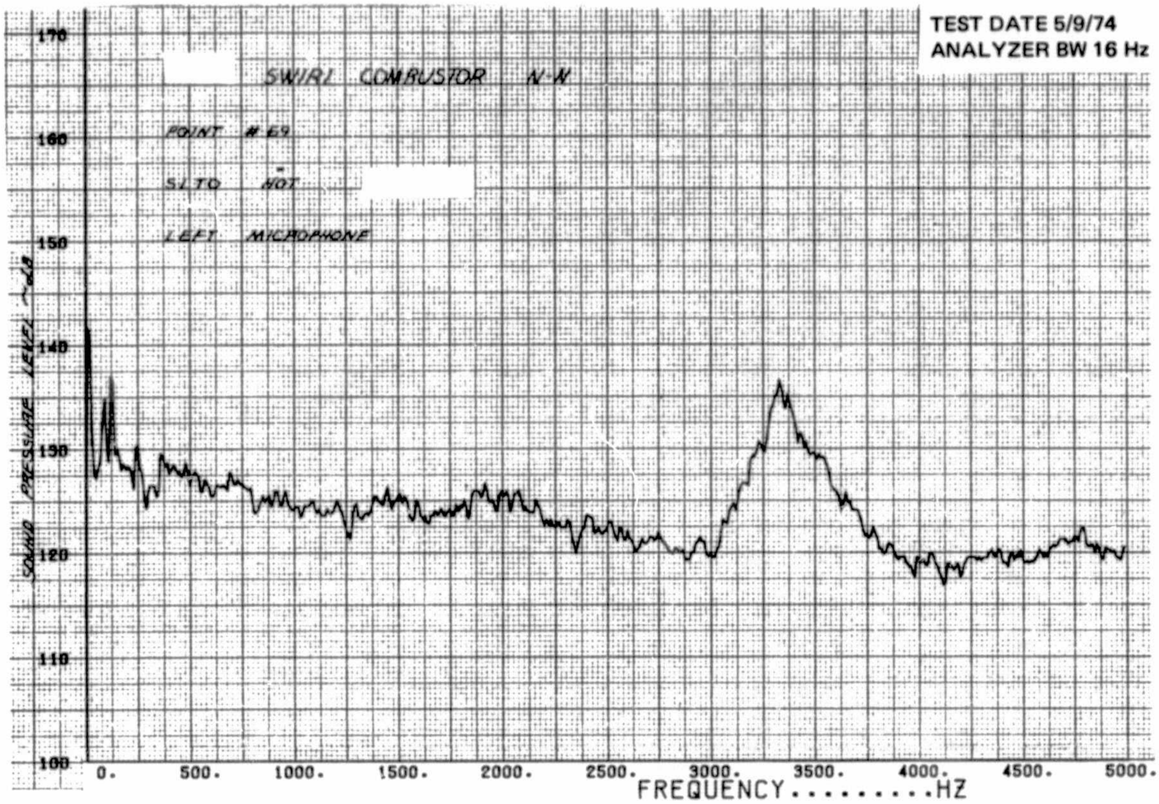

SWIRL CAN COMBUSTOR N-9
POINT # 81
IDLE ~ HOT
LEFT MICROPHONE
SOUND PRESSURE LEVEL ~ dB
160
150
140
130
120
110
0
1
2
3
4
5
FREQUENCY x 1000 Hz

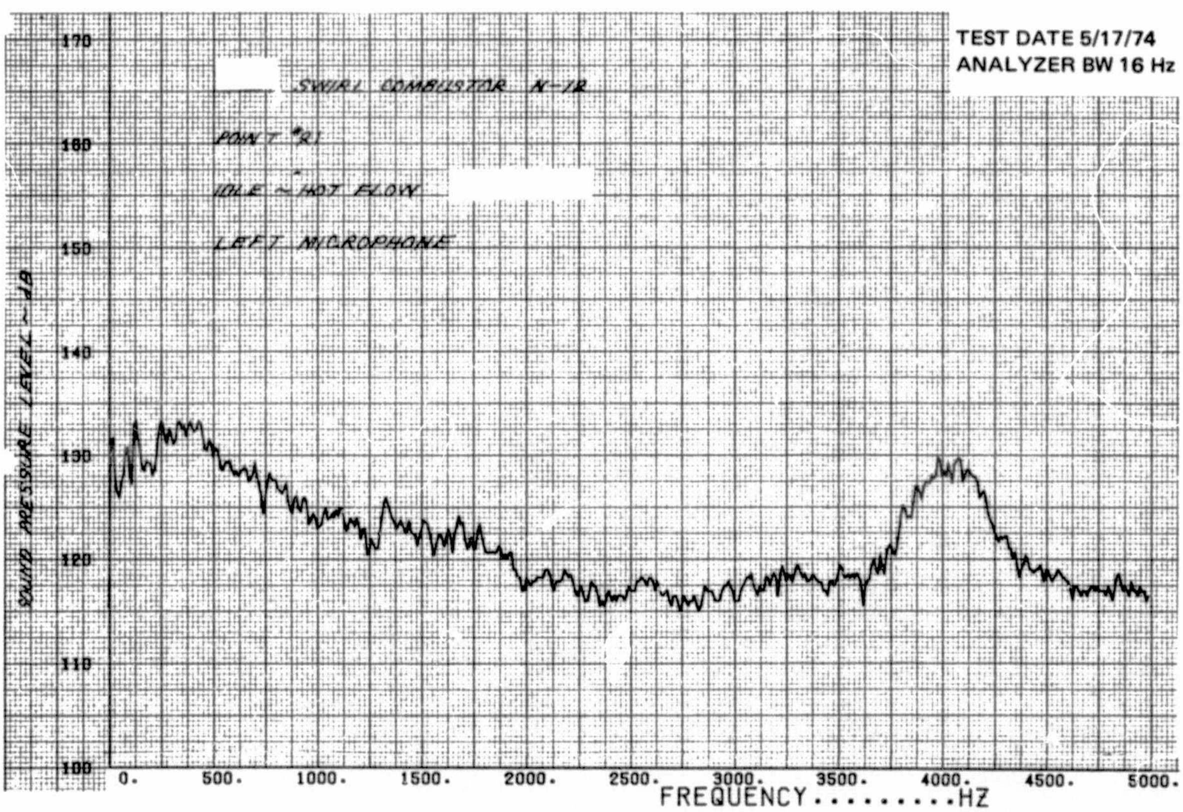

SWIRL CAN COMBUSTOR N-9
POINT # 69
SLTO ~ HOT
LEFT MICROPHONE
RIG 70490-9
X-903
4-29-74
16-Hz BAND WIDTH
SOUND PRESSURE LEVEL ~ dB
FREQUENCY X 1000 Hz

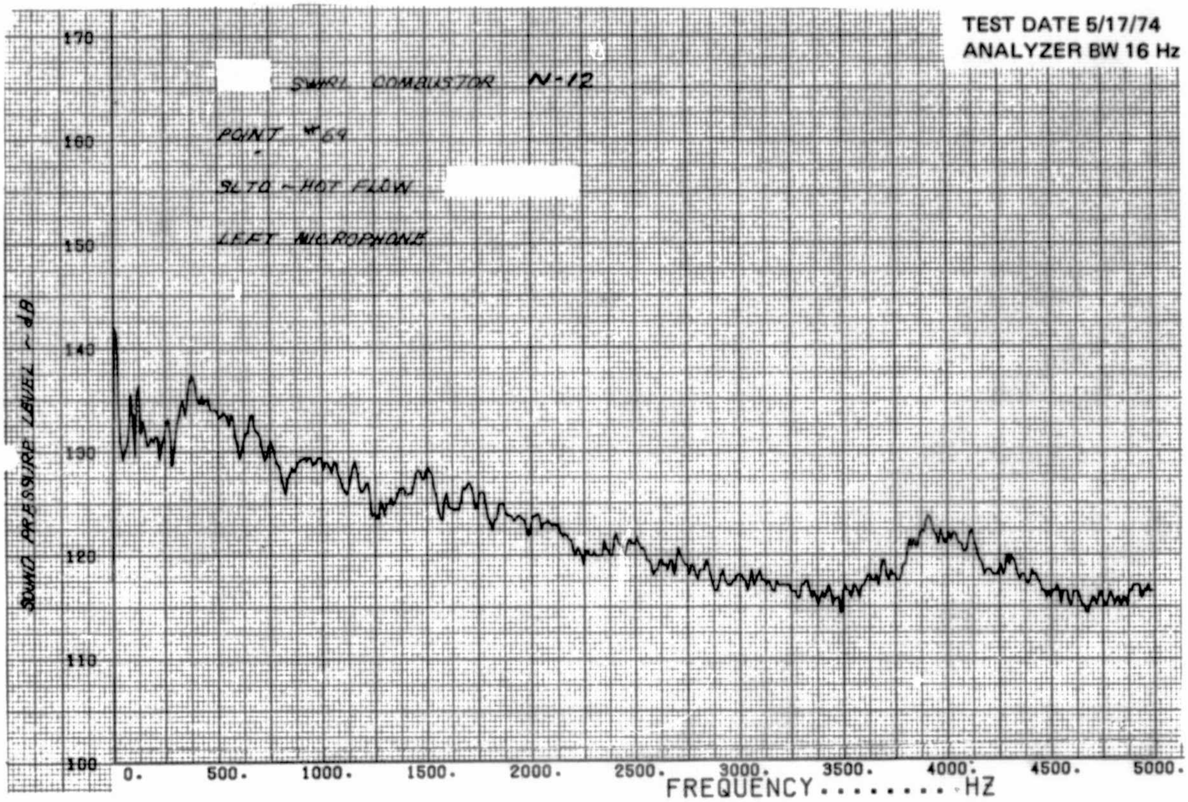

SWIRL COMBUSTOR N-10
POINT # 21
IDLE-HOT
LEFT MICROPHONE
RIG 70490-10
X-903
6-7-74
16 Hz BANDWIDTH
SOUND PRESSURE LEVEL ~ dB
FREQUENCY

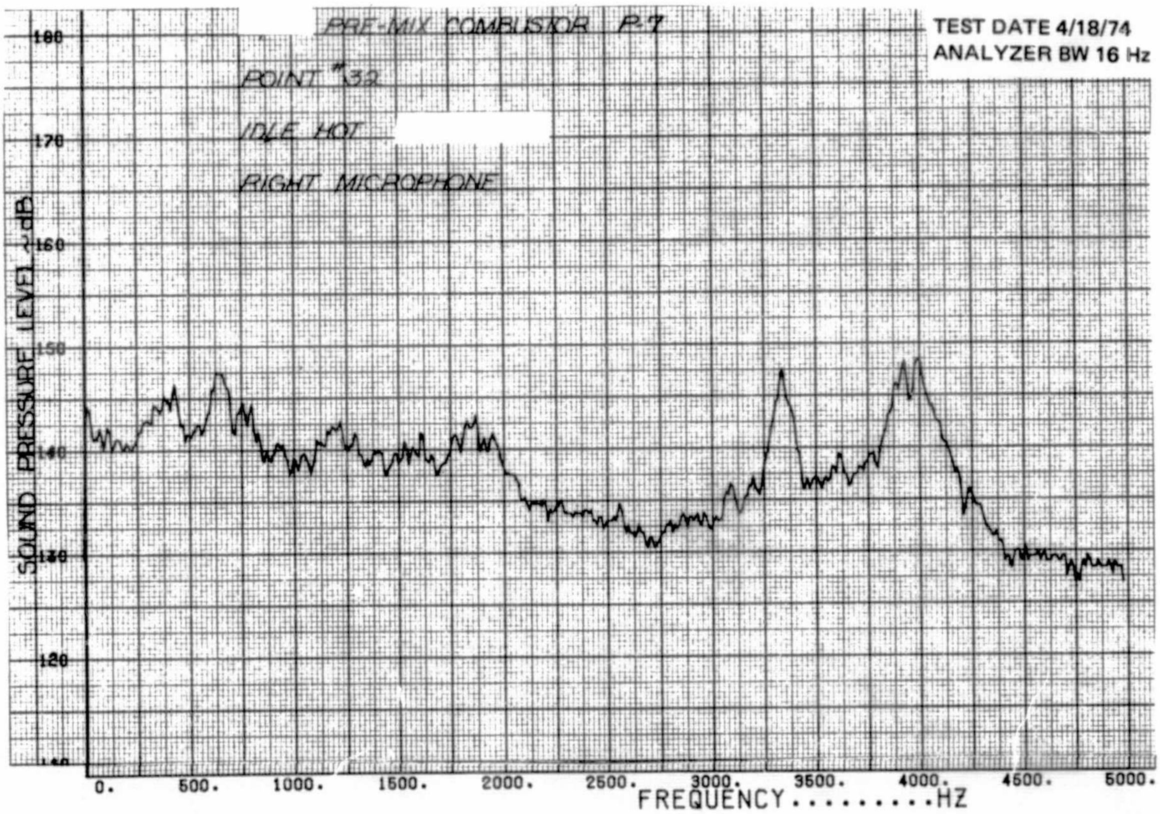

SWIRL COMBUSTOR N-10
POINT # 69
SLTO-HOT
LEFT MICROPHONE
16 Hz BANDWIDTH
SOUND PRESSURE LEVEL ~ dB
FREQUENCY

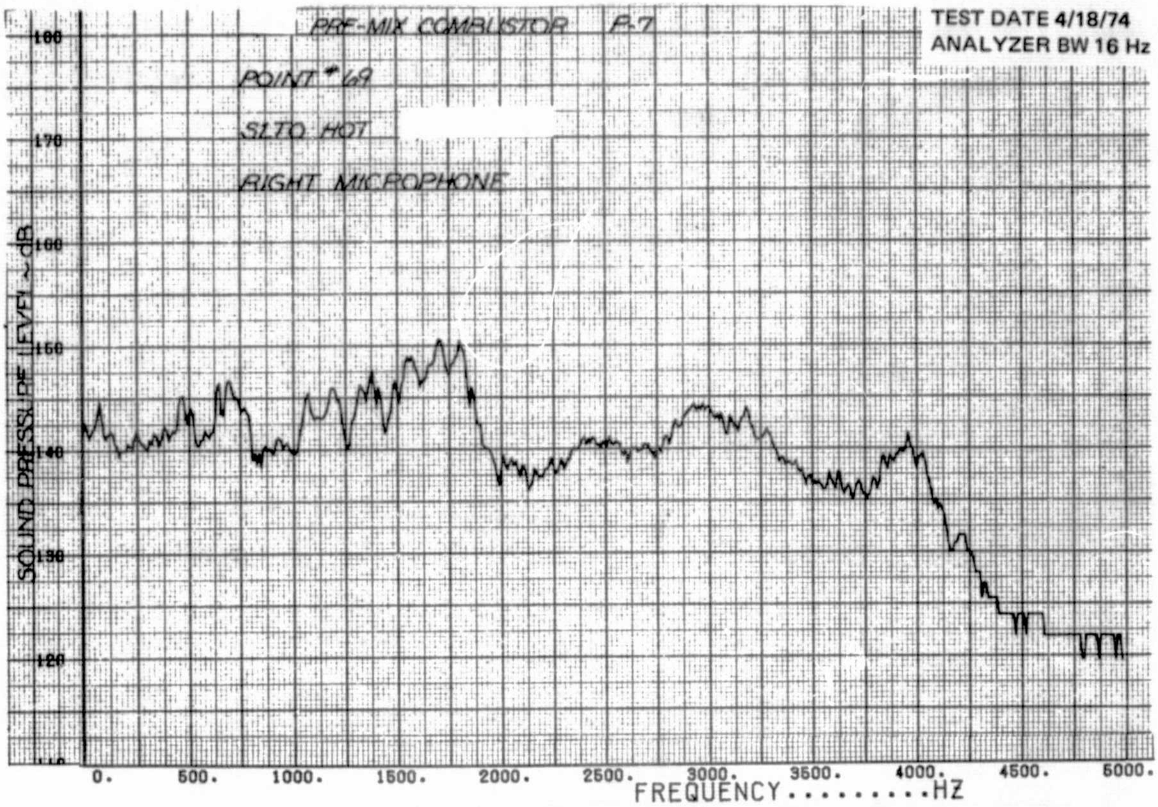

TEST DATE 4/29/74
ANALYZER BW 16 Hz
POINT # 21
IDLE HOT
LEFT MICROPHONE
SOUND PRESSURE LEVEL ~dB
170
160
150
140
130
120
110
0.
500.
1000.
1500.
2000.
2500.
3000.
3500.
4000.
4500.
5000.
FREQUENCY.........HZ

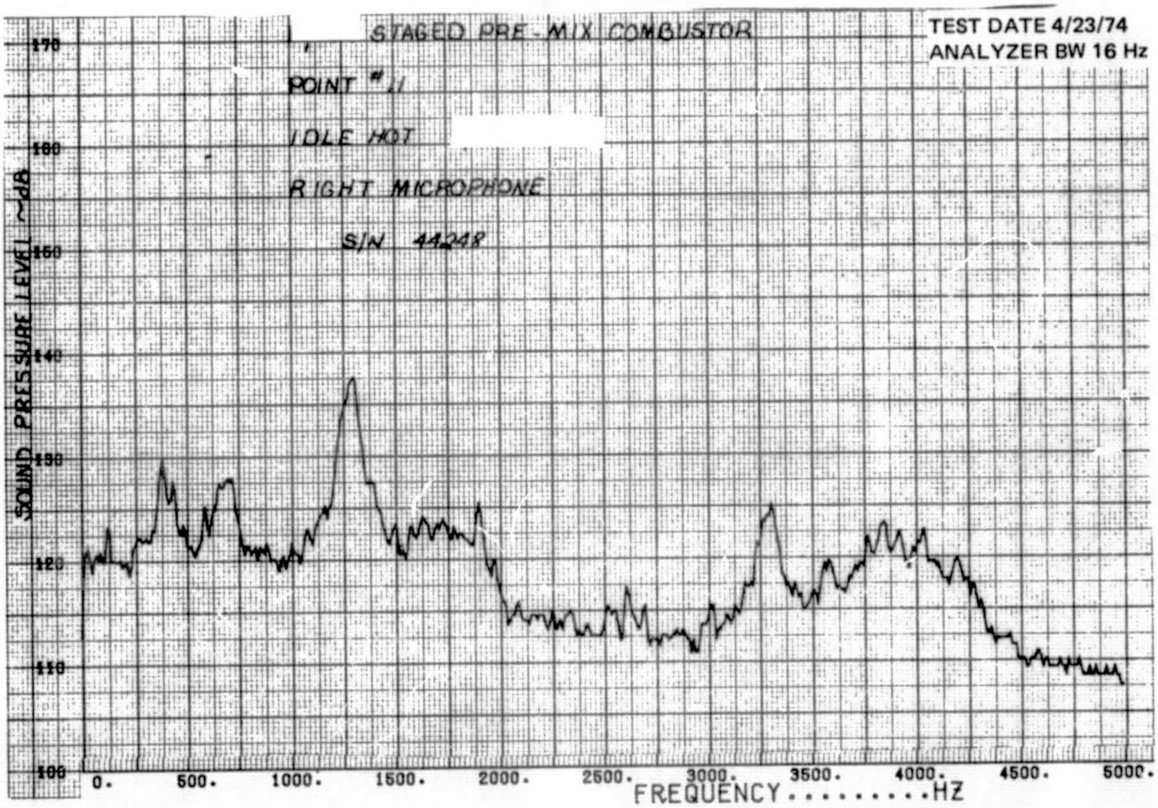

TEST DATE 5/9/74
ANALYZER BW 16 Hz
SWIRL COMBUSTOR N-N
POINT # 69
SLTO HOT
LEFT MICROPHONE
SOUND PRESSURE LEVEL ~dB
FREQUENCY.........HZ

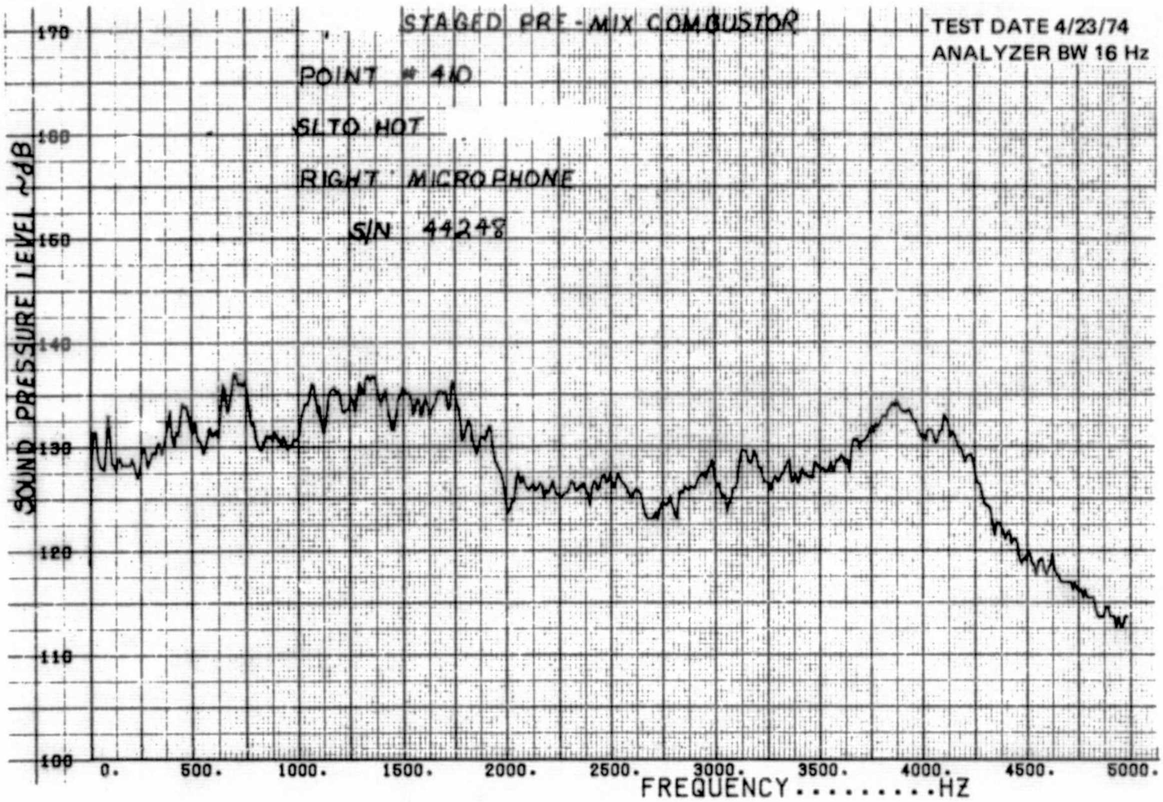

TEST DATE 5/17/74
ANALYZER BW 16 Hz
SWIRL COMBUSTOR N-12
POINT #21
IDLE ~ HOT FLOW
LEFT MICROPHONE
SOUND PRESSURE LEVEL ~dB
FREQUENCY.........HZ

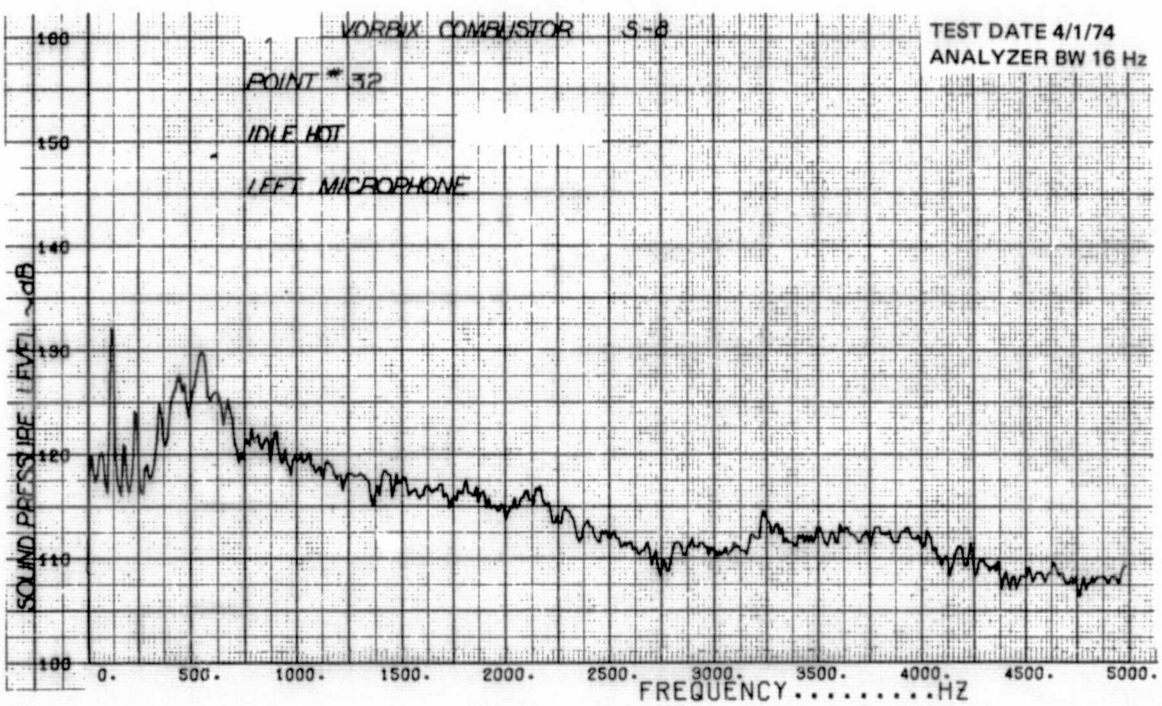

TEST DATE 5/17/74
ANALYZER BW 16 Hz
SWIRL COMBUSTOR N-12
POINT #69
SLTO - HOT FLOW
LEFT MICROPHONE
SOUND PRESSURE LEVEL ~ dB
170
160
150
140
130
120
110
100
0. 500. 1000. 1500. 2000. 2500. 3000. 3500. 4000. 4500. 5000.
FREQUENCY.........HZ

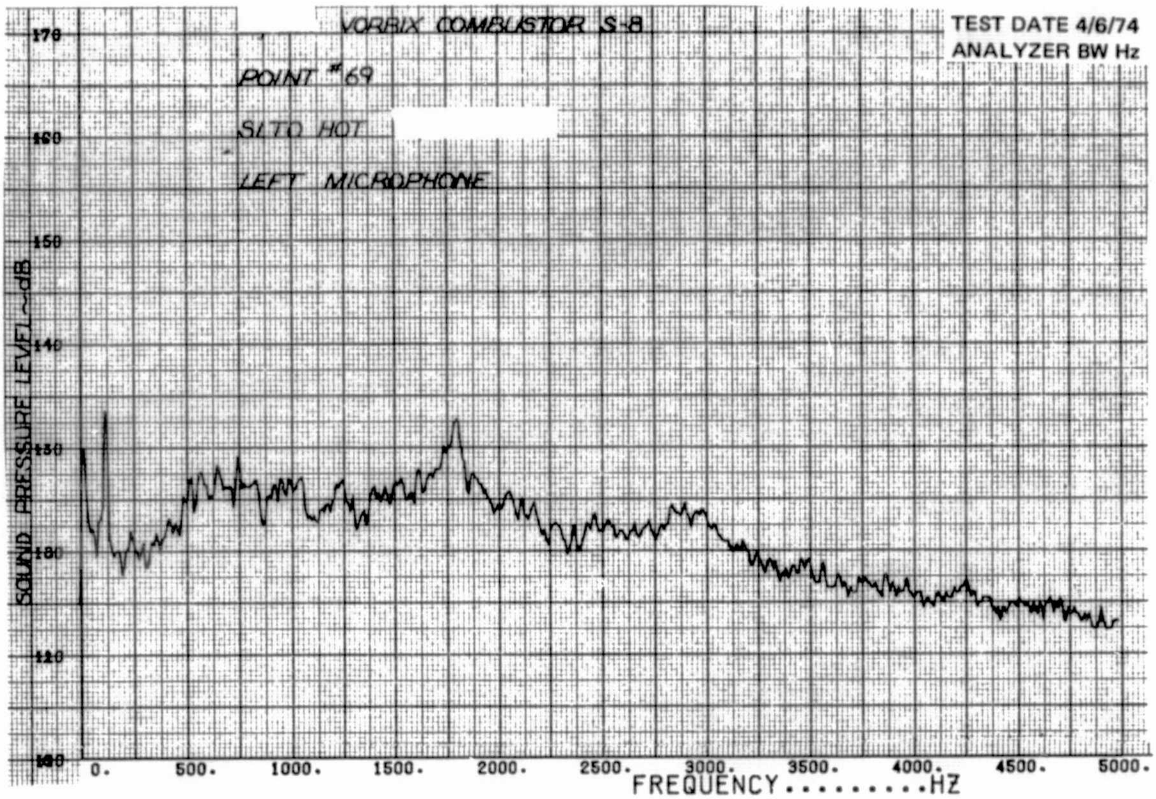

PRE-MIX COMBUSTOR P-7
TEST DATE 4/18/74
ANALYZER BW 16 Hz
POINT #32
IDLE HOT
RIGHT MICROPHONE
SOUND PRESSURE LEVEL ~dB
180
170
160
150
140
130
120
0. 500. 1000. 1500. 2000. 2500. 3000. 3500. 4000. 4500. 5000.
FREQUENCY.........HZ

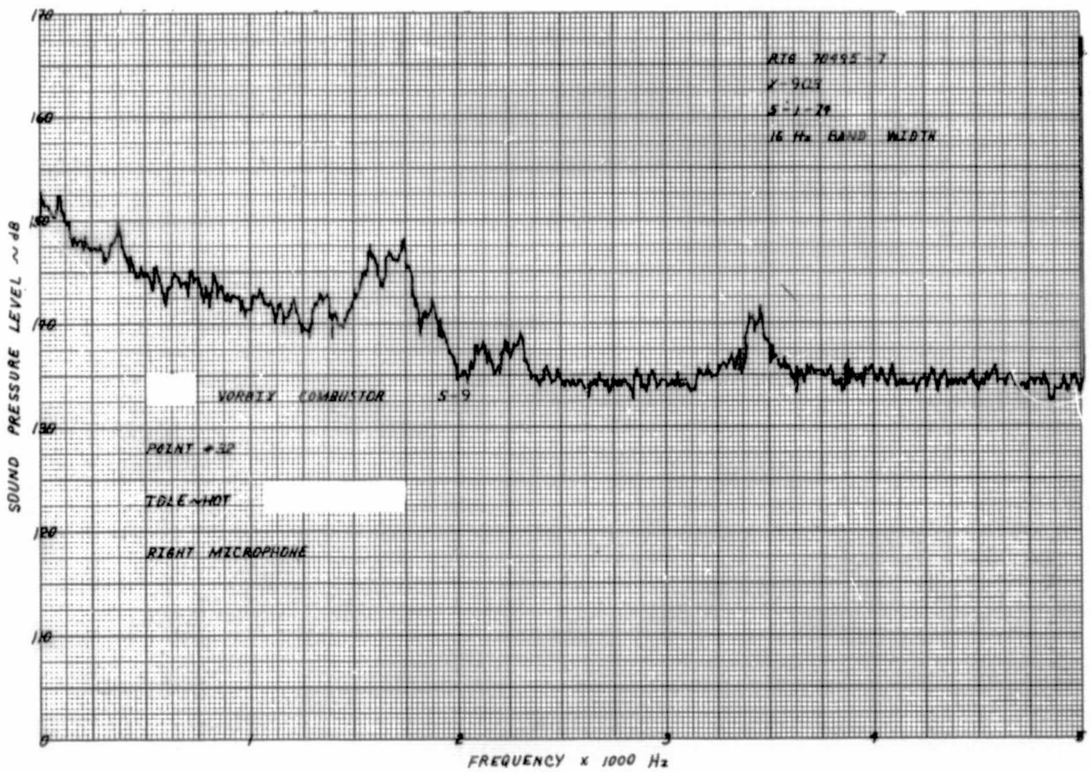

PRE-MIX COMBUSTOR F-7
TEST DATE 4/18/74
ANALYZER BW 16 Hz
POINT # 69
SLTO HOT
RIGHT MICROPHONE
SOUND PRESSURE LEVEL ~ dB
180
170
160
150
140
130
120
110
0.
500.
1000.
1500.
2000.
2500.
3000.
3500.
4000.
4500.
5000.
FREQUENCY.........HZ

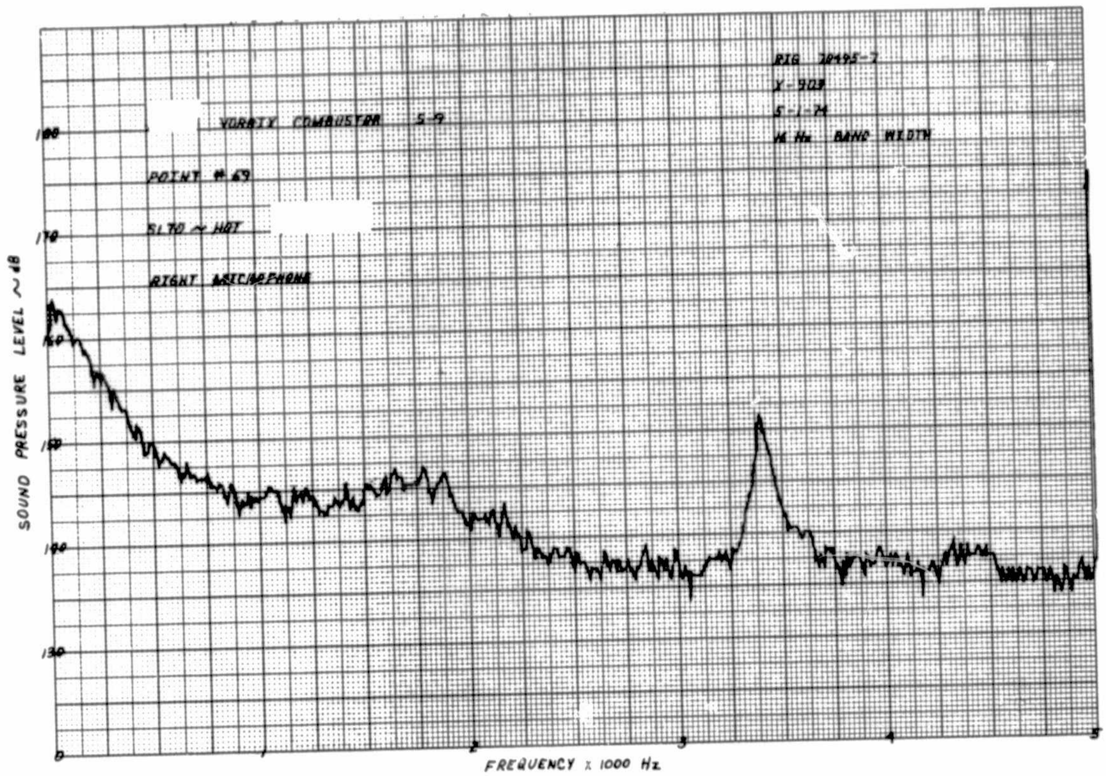

STAGED PRE-MIX COMBUSTOR
TEST DATE 4/23/74
ANALYZER BW 16 Hz
POINT # 11
IDLE HOT
RIGHT MICROPHONE
S/N 44248
SOUND PRESSURE LEVEL ~dB
170
160
150
140
130
120
110
100
0.
500.
1000.
1500.
2000.
2500.
3000.
3500.
4000.
4500.
5000.
FREQUENCY.........HZ


STAGED PRE-MIX COMBUSTOR
TEST DATE 4/23/74
ANALYZER BW 16 Hz
POINT # 410
SLTO HOT
RIGHT MICROPHONE
S/N 44248
SOUND PRESSURE LEVEL ~dB
170
160
150
140
130
120
110
100
0. 500. 1000. 1500. 2000. 2500. 3000. 3500. 4000. 4500. 5000.
FREQUENCY.........HZ


VORBIX COMBUSTOR S-8
TEST DATE 4/1/74
ANALYZER BW 16 Hz
POINT # 32
IDLE HOT
LEFT MICROPHONE
SOUND PRESSURE LEVEL ~dB
160
150
140
130
120
110
100
0. 500. 1000. 1500. 2000. 2500. 3000. 3500. 4000. 4500. 5000.
FREQUENCY.........HZ


VORBIX COMBUSTOR S-8
TEST DATE 4/6/74
ANALYZER BW Hz
POINT #69
SLTO HOT
LEFT MICROPHONE
SOUND PRESSURE LEVEL~dB
170
160
150
140
130
120
110
100
0.
500.
1000.
1500.
2000.
2500.
3000.
3500.
4000.
4500.
5000.
FREQUENCY.........HZ


RIG 70495-7
V-903
5-1-74
16 Hz BAND WIDTH
VORBIX COMBUSTOR S-9
POINT #32
IDLE~HOT
RIGHT MICROPHONE
SOUND PRESSURE LEVEL ~ dB
170
160
150
140
130
120
110
0
1
2
3
4
5
FREQUENCY x 1000 Hz



VORBIX COMBUSTOR S-9
POINT # 69
SL70 ~ HOT
5-1-74
16 Hz BAND WIDTH
SOUND PRESSURE LEVEL ~ dB
FREQUENCY x 1000 Hz